

A REVISION OF THE NEARCTIC SPECIES OF
LIMNELLIA MALLOCH (DIPTERA: EPHYDRIDAE)

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Abstract.—Nearctic species of *Limnellia* Malloch are revised. Of the 10 species considered, the following seven are newly described, with type-localities listed in parentheses: *L. andersoni* (3 mi SE Auburn, Calif.); *L. balioptera* (23.2 mi S South Bend, Wash.); *L. huachuca* (Ramsey Canyon, Ariz.); *L. lactea* (Rustler Park, Ariz.); *L. lecocercus* (Robson, British Columbia); *L. sticta* (Knowlton Ldg., Quebec); *L. turneri* (Mt. Rainier, Berkeley Park, Wash.). *L. oscitans* (Walker) is synonymized under *L. stenhammari*. All Nearctic species except *L. stenhammari* are endemic, the latter is the only species known to occur in both western and eastern North America; and *L. quadrata* (Fallén) has not been found in North America. Male genitalia are used extensively to distinguish species, these are illustrated for most species. A key, wing photos, and distribution maps are also provided.

Introduction and Review

Many Diptera, particularly those inhabiting boreal zones at northern latitudes, have Holarctic distributions (Vockeroth, in preparation). Species thus distributed have often been described more than once, each without considering the adjoining but sometimes disjunct fauna. Sometimes a disjunct distribution has itself been interpreted as sufficient evidence for a second description. The opposite also occurred. Older names of well known European species have frequently been used for similar appearing, but distinct Nearctic species, the identities of which were discovered later. Both situations are apparent with species of the shore fly genus *Limnellia* Malloch. The resulting confusion has prompted the present endeavor.

Solving many of these problems is due in large measure to Andersson's (1971) revision of the European *Limnellia*. In this thorough work, adequate descriptions and illustrations were made available for European species. Andersson also examined type specimens, usually syntype series, and where necessary designated lectotypes. With reliable information on the European species, much of the confusion noted above could be clarified.

The shore fly genus *Limnellia* presently numbers 16 species, seven of which are described below. Prior to the present revision, the only treatments of the Nearctic species other than isolated species descriptions and catalogue entries were those of Cresson (1935) and Sturtevant and Wheeler

(1954). Cresson's review considered the world fauna, whereas Sturtevant and Wheeler's synopsis treated Nearctic species only. Sturtevant and Wheeler considered *Limnellia* to be a subgenus of *Scatella* Robineau-Desvoidy, although they felt that ". . . *Limnellia* is the one of the subgenera here recognized that is most nearly deserving of generic standing."

Wirth and Stone (1956) and Deonier (1964) published studies on the shore fly faunas of California and Iowa respectively. Both studies include keys to the *Limnellia* species occurring within each state.

Characters of the male postabdomen of *Limnellia* were illustrated and described first by Wirth (1948) who studied males of *L. sejuncta* (Loew). Andersson (1971) figured and described these structures for each species in his revision of the European fauna and demonstrated their usefulness as characters for species identification. In the present study, I found characters of the male postabdomen to be reliable and in several cases have utilized them for recognizing species.

Methods and Materials

The present revision is based on study of nearly 500 specimens from the collections listed below. Included with the listings are the curators responsible for loaning the specimens, acronyms to identify the collection in which the specimens are housed, and asterisks to indicate institutions from which holotypes were borrowed.

Academy of Natural Sciences of Philadelphia (ANSP)—Dr. Wayne W. Moss.

American Museum of Natural History (AMNH)—Dr. Pedro W. Wygodzinsky.

*British Museum (Natural History) (BMNH)—Dr. Brian H. Cogan.

California Academy of Sciences (CAS)—Dr. Paul H. Arnaud, Jr.

Canadian National Collection (CNC)—Dr. J. Richard Vockeroth.

*Museum of Comparative Zoology (MCZ)—Ms. Margaret Thayer.

National Museum of Natural History (USNM).

University of Kansas (KU)—Dr. George W. Byers.

University of Minnesota (UMI)—Dr. Philip J. Clausen.

Washington State University (WSU)—Dr. William J. Turner and Mr. Richard Zack.

Wayne N. Mathis (WNM)—personal collection.

Label data and depositories for all specimens of the type series I examined are cited in full. Label data for other specimens examined have been condensed (locality, habitat data, sex, depository) and arranged alphabetically.

Descriptive ratios are explained elsewhere (Mathis, 1977); each is an average of measurements taken from four specimens when available. Specimens to be measured were selected as follows: the largest, the smallest, and two others picked randomly.

The illustrations were inked on drafting film from drawings made using a Wild M20 compound microscope equipped with a drawing tube. The scale of each illustration is indicated by a line, which equals 0.1 mm. I have endeavored to portray the same aspect when drawing homologous structures. The epandrium of male specimens has randomly scattered, hairlike setae in addition to the larger bristles. Rather than draw each of these, I have included only a small patch in most of the drawings to indicate their size and arrangement. Structures to be illustrated were mounted on temporary slides using a glycerin-jelly mounting medium. Wing photographs were taken from permanently slide-mounted preparations.

Limnellia Malloch

Limnellia Malloch, 1925:331. Type-species: *Limnellia maculipennis* Malloch, by original designation and monotypy.

Eustigoptera Cresson, 1930:126. Type-species: *Notiphila quadrata* Fallén, by original designation. Synonymy by Cresson, 1935:362.

Stictoscatella Collin, 1930:133. Type-series: *Notiphila quadrata* Fallén, by original designation. Synonymy by Cresson, 1935:362.

Stranditella Duda, 1942:30 (as subgenus of *Scatella*). Type-species: *Notiphila quadrata* (Fallén), by original designation. Synonymy by Dahl, 1959:126.

Diagnosis.—Specimens of *Limnellia* are distinguished from those of other genera of the tribe Scatellini as follows: 1 pair of well-developed, latero-clinate, fronto-orbital bristles; gena narrow; thorax mostly brownish black to black, but with cinereous vittate and guttate markings; acrostichal setae arranged in 2 rows, each extending to base of scutellum; dorsocentral bristles 2 (0 + 2); wing maculate, mostly dark brown, with white, generally guttate markings; abdominal terga black, becoming polished, smooth, and shiny posteriorly; surstyli well developed as unfused processes at ventral margin of epandrium; aedeagal apodeme rudimentary.

Description.—Small to moderately-small shore flies, length 1.24–2.47 mm; mostly dark brown to black, pollinose to shiny, frequently with cinereous, guttate and vittate markings; wings maculate.

Head.—Wider than high from cephalic view; frons wider than long, vestiture more or less uniform, pollinose, dull, coloration varying, brown to charcoal brown, frequently with cinereous areas; mesofrons broadly triangular, narrowing anteriorly, forming an obtuse, rounded angle, not differentiated from parafrons except by differences in conformational relief; parafrons generally similar to mesofrons, occasionally slightly darker,

more charcoal colored, narrowing posteriorly, forming an acute angle between convergence of fronto-orbital plate and mesofrons; fronto-orbital plate distinct only by differences in conformational relief, paralleling dorsal margin of eye. Ocelli arranged in equilateral triangle, on suboval plate which is slightly raised in relief. Two pairs of fronto-orbital bristles, anterior pair much smaller, proclinate; posterior pair of fronto-orbitals latero-clinate; 1 pair each of inner and outer vertical bristles, distance between them less than between inner vertical and postermost fronto-orbital; 1 pair of large, proclinate, divergent ocellar bristles, insertions aligned with median margin of posterior ocelli; 1 or 2 pairs of much smaller postocellar setae. Antennae generally dark, black, occasionally with pale areas; third segment macropubescent to tomentose, longer than combined length of first and second segments, broadly rounded apically; arista inserted dorsally near posterodorsal corner of third segment, thickened basally, tapering gradually to stylelike tip, with short, micropectinate branching above. Face generally pollinose to tomentose; antennal fovea shallowly impressed; interfoveal carina not projecting as in other Scatellini; portion of face below antennal fovea setulose, with 2-3 pairs of posterolatero-clinate, larger setae dorsally and several ventroclinate setae along oral margin, these becoming larger toward lateral margins; 2-3 indistinct, small, parafacial setae. Eye nearly round, oriented at slight oblique angle to plane of epistoma, bare; gena very narrow, postgena widening, setulose, with 1 large pair of bristles. Mouthparts generally retracted into oral opening, clypeus not exposed; maxillary palp dark colored; prementum longer than wide; pollinose to tomentose.

Thorax.—Generally pollinose, dull, dark brown with cinereous guttate or vittate markings. Mesonotum dull to slightly subshiny, generally pollinose, anterior portion duller, more densely pollinose, usually with paired, guttate to vittate, cinereous areas just laterad of acrostichal tract, cinereous color weakening abruptly to form a faintly, lighter colored vitta which gradually blends with surrounding color posteriorly; color of acrostichal tract generally brown with distinct cinereous vitta developing posteriorly between setae, evident for about posterior two-thirds of mesonotal length, becoming stronger posteriorly; humeral callus cinereous dorsally 1 or 2 pairs of additional cinereous guttate to vittate areas lateral and paralleling dorso-central tract; scutellum generally flat, subshiny. Chaetotaxy of thorax as follows: acrostichal setae arranged in 2 rows which extend to base of scutellum, none prominently larger than others, 2 pairs of larger dorso-central bristles (0 + 2) and 3-4 setae, especially anteriorly; postermost dorsocentral slightly displaced laterally; 1 pair of presutural bristles; 2 pairs of notopleural bristles, both near ventral margin of notopleuron; 1 pair of posterior supra-alar bristles; 2 pairs of lateral scutellar bristles, anterior pair less than one-third length of posterior pair; 1 pair of large meso-

pleural bristles near posterior margin at middle; 1 pair of sternopleural bristles; mesopleuron and sternopleuron usually more pollinose, cinereous for the most part. Legs generally dark, tending to be subshiny to shiny; femora and tibiae dark, brownish black to black; color of tarsi variable, apical tarsomeres generally dark regardless of color of basitarsi; fore femur with row of setae along posteroventral margin; mid femur with row of setae along anterior surface, becoming stronger apically. Prosternum bare. Wing maculate, mostly dark brown with white or hyaline markings, these mainly guttate; maculation pattern variable but generally recognizable for each species. Halter color variable, yellowish to dark brown.

Abdomen.—Generally black, anterior terga with pollinose, brownish-black vestiture, posterior segments becoming polished, shiny; both sexes with 5 terga exposed, occasionally females with posterior portion of sixth exposed; fifth tergum generally truncate posteriorly. Male genitalia as follows: symmetrical; surstyli well developed as unfused processes at ventral margin of epandrium, shape of epandrium and surstyli diagnostic at species level; aedeagal apodeme generally reduced, broadly Y-shaped, with each arm attached to posterodorsal corners of aedeagus; gonite with larger process oriented ventrally and with second, smaller, thin process more or less fused apically with similar process from opposite side, forming an irregularly-shaped loop through which the aedeagus projects; aedeagus with sclerotized and membraneous areas, usually longer than high, frequently with V-shaped notch dorsally.

Geographic distribution.—In general, the paucity of locality data for several species precludes a meaningful synthesis at this time. For the Nearctic Region; two species are known from their type-localities only, two others from three or fewer localities. Consequently my comments below are primarily descriptive and lack satisfactory explanations.

Limnellia is worldwide in distribution, with members occurring in all major faunal realms. More species are presently known from the Northern Hemisphere, which may or may not be reflective of their actual diversity. Vast areas of the Southern Hemisphere have simply not been collected. The only species known from the Afrotropics, for example, were described within the last decade (Canzoneri and Meneghini, 1969).

Of the Nearctic species of the genus, only *L. stenhammari* is known to occur also in the Palearctic Region; apparently the remaining Nearctic species are endemics. *Limnellia turneri*, n. sp., has been misidentified for over a century as *L. quadrata* (Fallén) (European), and as such it was thought to be Holarctic. Not until Andersson's recent revision of the European species (1971) was the true identity and narrower distribution of the latter made known.

Eight of the 10 known Nearctic species occur in western North America, mostly from the Rocky Mountains westward. These western species, com-

prising one-half of the world's known species are endemics for the most part. Only *L. stenhammari* is widespread, occurring in both the east and west. Some species are associated with fairly specific or identifiable geographic features. *Limnellia sejuncta* appears to be closely linked with the Pacific Coast; *L. huachuca* with the semi-isolated mountain ranges along the common border of the United States and Mexico. Other species are widespread, notably *L. stenhammari* and to a lesser extent *L. turneri*. The reason(s) for either type of distribution has not been discovered.

The distribution of each Nearctic species overlaps to some degree that of at least one other species of the genus. Where species occur in sympatry, species identifications can usually be made accurately without reference to structures of the male genitalia. Examination of these structures is sometimes necessary for identification of allopatric populations.

Natural history.—Virtually nothing is known of the immature stages, behavior, or habitat preferences of *Limnellia* species. In Scandinavia, Dahl (1959) reported that specimens of *L. stenhammari* exhibit weak xerophilous tendencies, preferring drier meadow and dune heath habitats. Adults of other species are collected more often by sweeping through emergent vegetation from wet meadow habitats and similar situations along lotic and lentic aquatic systems. Sturtevant and Wheeler (1954) noted that *Limnellia* specimens have also been collected from tree trunks and flowers.

Variation.—Characters of the wing maculation pattern have been used extensively for identifying species of *Limnellia*. The pattern of white spots against a dark background is conspicuous and fairly constant. However, caution should be exercised in giving undue emphasis to these characters alone, as they are known to vary. Furthermore, the patterns of some species are almost identical and the intra- and interspecific variations broadly overlap. Where intraspecific variations appear more commonly, I have included wing photos of them as an aid to species identification.

Caution should also be exercised in relying on the color of halteres and basitarsi without supporting characters to determine a species identity. Although the color of these structures generally holds as described, I have examined occasional specimens that differ. This is especially evident with teneral specimens, where typically black colored structures are frequently reddish or yellowish red. Facial color also varies, and I have used it to characterize a species only when it complements other characters and when the facial color pattern is relatively constant. Too frequently, a "rubbed" specimen, or one that is greasy, makes use of these characters for species recognition futile.

Discussion.—I follow Wirth (1965) in placing *Limnellia* in the subfamily Ephydrinae, tribe Scatellini. Characters evidencing these relationships

and by which the subfamily and tribe are recognized are: face slightly arched transversely, setulose, particularly along the ventral margin; tarsal claws short and curved; and pulvilli normally developed. Within Scatellini, however, the relationship of *Limnellia* to other taxa has not been specified other than unannotated classifications or vaguely worded statements allying it with *Scatella*. *Limnellia* has been treated as a subgenus of the latter by some authors.

The sister-group of *Limnellia* is *Scatophila* Becker. This relationship is confirmed by the following apotypic character states:

1. Number of fronto-orbital bristles.—The common number throughout the subfamily is two pairs of latero-clinate, fronto-orbitals. Specimens of *Limnellia* and *Scatophila* have only one pair.
2. Thoracic coloration and vestiture.—The plesiotypic condition is for a more or less unicolorous thorax or one with gradually-blending color changes. The thorax in *Scatophila* and *Limnellia* specimens is bi- or tricolored, with each color being sharply demarcated from the other(s). Frequently the contrasting marks are cinereous, either as guttate or vittate markings and are particularly evident on the dorsum.
3. Aedeagal apodeme.—The shape of this structure appears to form a multidirectional morphocline. In males of *Scatophila* and *Limnellia*, the aedeagal apodeme is rudimentary, as a connecting, rod-like structure between the base of the aedeagus and the hypandrium or fused apices of the ventral gonapophysis. Basally, the apodeme is frequently bifurcate, as in *Limnellia* males, forming a Y-shaped structure.

Apotypic character states distinguishing *Scatophila* are:

4. Extension of costal vein.—The costa extends to vein R_{4+5} (3rd vein) in *Scatophila* wings, which is the apotypic state. Throughout the remainder of the subfamily, the costa reaches vein M_{1+2} (4th vein).
5. Surstyli.—Paired surstyli are lacking or have been fused indistinguishably with the ventral margin of the epandrium in males of *Scatophila*. In males of *Limnellia*, as well as the subfamily in general, the surstyli are conspicuous, usually as setulose processes. The surstyli are frequently of diagnostic importance for distinguishing taxa at various levels in the subfamily.

Apotypic character states distinguishing *Limnellia* are:

6. Wing maculation pattern.—The wing maculation pattern appears to be a simple morphocline in which the plesiotypic state is a hyaline wing, characteristic of most members of Ephydrinae. At

the next level, the wing is lightly infuscated, grayish to tan, with a pattern of white areas arranged as follows: cell R_1 with one white spot, sometimes subquadrate, more or less aligned or slightly apicad of posterior crossvein; cell R_3 with two white spots on either side of posterior crossvein; discal cell with one white spot, often subdivided, near the apical end; cell M_2 with one basal white area, frequently large and irregular in shape and/or subdivided; cell M_4 with one to two white areas, usually in apical one-half. Some inter- and intraspecific variation occurs, usually by the addition of white spots. In *Limnellia* wings, the addition of several more white spots becomes consistent and the wing membrane around the spots becomes darker, brownish black.

7. Aedeagus.—The aedeagus of *Limnellia* males has an anteroventral, median, slightly-curved prong which to my knowledge is unique within the subfamily.

Because the present study is not a world revision, I have not attempted a detailed account of the species relationships of Nearctic *Limnellia*. However, certain tendencies are evident and will provide a basis for future studies. These are outlined in Fig. 1 plus the accompanying list of character evidence.

8. Size of surstyli.—The common condition in the species I have examined is for the surstyli to be longer than wide. The apotypic state is for each surstylus to be wider than long.
9. Shape of aedeagus.—This character is multidirectional. I interpret the plesiotypic state to be the common condition as in *L. stenhammari*, for example, where the aedeagus is longer than wide and has a distinct V-shaped notch dorsally. The lineages indicated with this number represent derived conditions from the common state described. The specific state is best shown in the illustrations accompanying the taxa whose lineage is being characterized.
10. Wing maculation pattern.—Although several patterns are evident, that exhibited by *L. turneri* is most common, especially the two darker brown spots in cell R_5 along the posterior margin of vein R_{4+5} . Variations from that pattern are apotypic and like number 9 above, are best seen by examining the appropriate wing photos.
11. Size of epandrium.—The epandrium is most often quite small as compared with overall length of the specimen. But in males of *L. sejuncta* and *L. balioptera*, the epandrium is considerably larger, a condition I interpret as apotypic.
12. Shape of ventral margin of epandrium.—Typically the epandrium terminates ventrally rather abruptly; frequently it is truncated. In males of *L. anna*, *L. lecocercus*, and *L. anderssoni*, however, the

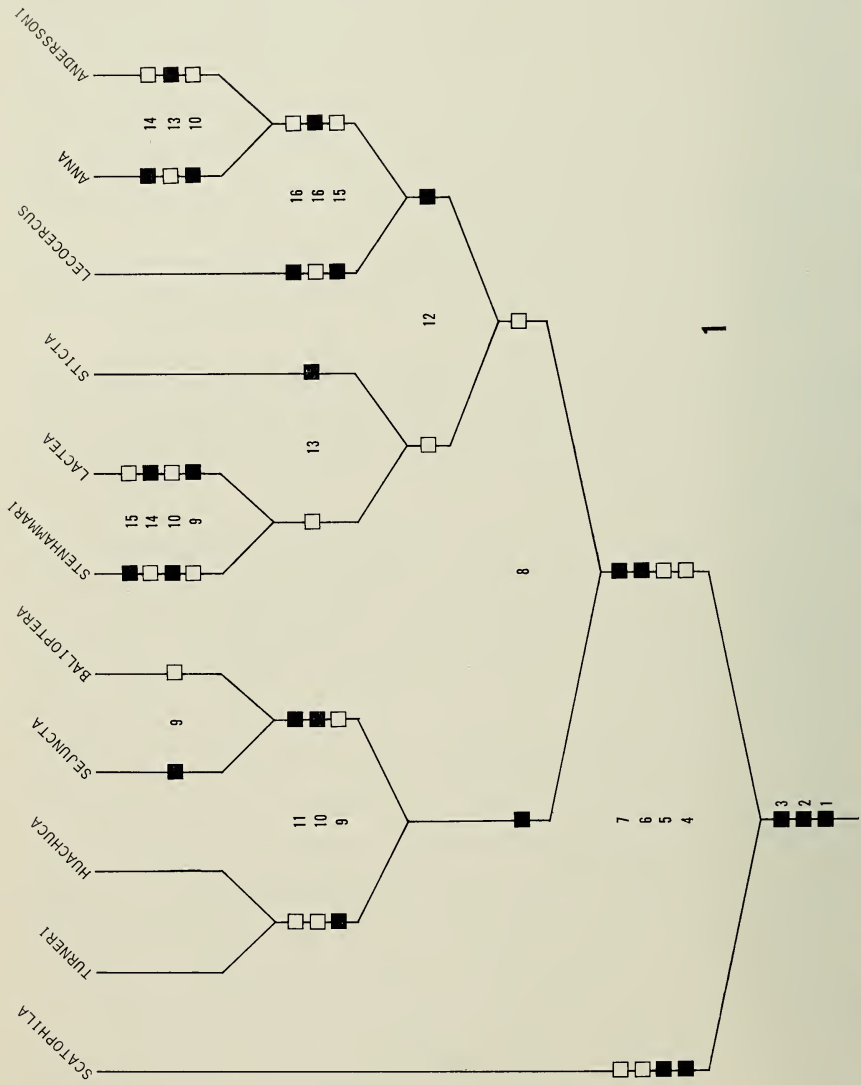


Fig. 1. Argumentation scheme for the hypothetical phylogeny of the Nearctic species of *Linnellia*. Filled square = apotypic state, open square = plesiotypic state.

- ventral margin narrows, forming a parallel-sided projection to which the surstyli are attached. The latter condition is apotypic.
13. Color of halteres.—The most common color for the halteres is brownish yellow to brown. Pale yellow halteres, as in *L. sticta* and *L. anderssoni* are apotypic.
 14. Facial color.—I interpret this character to be at least a duo morphocline. The most frequent color is grayish brown to yellowish brown, sometimes with faint indications of a darker, transverse band. The milky-white face of *L. lactea* and the distinctly banded face of *L. anna* are apotypic.
 15. Color of basitarsi.—Throughout the subfamily Ephydrinae, the most common color is pale yellow. Accordingly, I consider the black basitarsi, as in *L. stenhammari*, to be apotypic.
 16. Shape of surstyli.—I believe the plesiotypic condition is subrectangular surstyli, as in males of *L. stenhammari*. Marked deviations from that basic form are apotypic. Certainly the shape of these structures in *L. lecocercus*, *L. anna*, and *L. anderssoni* are unique.

Checklist of *Limnellia* species

1. *L. anderssoni*, new species. Nearctic.
2. *L. anna* Cresson, 1935:363. Nearctic.
3. *L. balioptera*, new species. Nearctic.
4. *L. fallax* (Czerny), 1903:239. Palearctic.
L. pauciguttata (Strobl), 1910:208. Palearctic.
5. *L. huachuca*, new species. Nearctic.
6. *L. lactea*, new species. Nearctic.
7. *L. lecocercus*, new species. Nearctic.
8. *L. maculipennis* Malloch, 1925:331. Australian.
9. *L. minima* Canzoneri and Meneghini, 1969:105. Afrotropical.
10. *L. picta* Canzoneri and Meneghini, 1969:106. Afrotropical.
11. *L. quadrata* (Fallén), 1813:255. Palearctic.
L. gramium (Haliday), 1833:176. Palearctic.
12. *L. sejuncta* (Loew), 1863:326. Nearctic.
13. *L. stenhammari* (Zetterstedt), 1846:1842. Holarctic.
L. oscitans (Walker), 1849:1106. Nearctic.
14. *L. sticta*, new species. Nearctic.
15. *L. surturi* Andersson, 1971:56. Palearctic.
16. *L. turneri*, new species. Nearctic.

Key to Nearctic Species of *Limnellia*

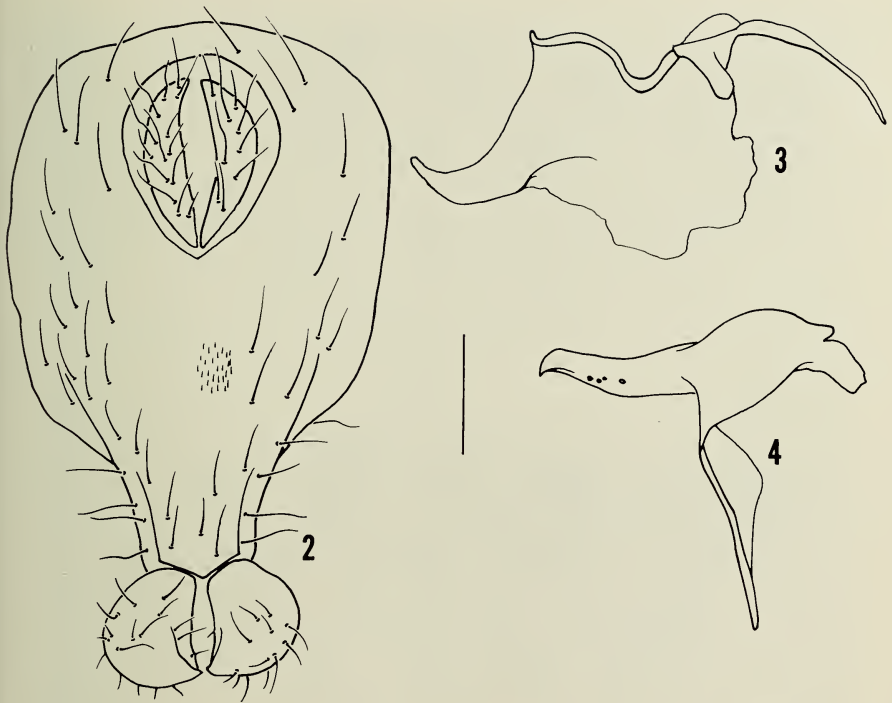
1. Lower portion of face transversely banded, ventral margin cinereous, contrasting distinctly with dorsally bordering brown band;

- antennal fovea shallow, little evident; costal vein index averaging 1:0.35 *L. anna* Cresson
- Ventral portion of face unicolorous; antennal fovea more deeply impressed; costal vein index averaging 1:0.25 or less 2
2. Legs, including tarsi, generally unicolorous, black 3
- Tarsi mostly pale, yellowish, contrasting with black tibiae 5
3. Wing cell R_5 with 3 darker spots closely appressed to vein R_{4+5} *L. stenhammari* (Zetterstedt)
- Wing cell R_5 with 2 darker brown spots closely appressed to vein R_{4+5} 4
4. Surstyli fused basomedially, together forming a broad, semi-circular plate; epandrium distinctly narrowing ventrally *L. lecocercus*, new species
- Surstyli not fused medially, each subrectangular; epandrium uniformly wide *L. turneri*, new species
5. Wing cell R_5 with 1 or 2 darker spots wholly separated from vein R_{4+5} by hyaline area 6
- Wing cell R_5 with darker spots touching vein R_{4+5} 7
6. Halter distinctly pale, yellowish; large species, wing length averaging 2.75 mm *L. balioptera*, new species
- Halter darker, brownish yellow to black; smaller species, wing length averaging less than 2.30 mm *L. sejuncta* (Loew)
7. Halter distinctly pale, yellowish 8
- Halter darker, brownish yellow to black 9
8. Epandrium narrowing ventrally more abruptly; surstyli only slightly longer than wide (California) *L. anderssoni*, new species
- Epandrium gradually narrowing ventrally; surstyli nearly 3 times longer than middle width (Quebec) *L. sticta*, new species
9. Face generally lacteus; surstyli about twice as long as middle width *L. lactea*, new species
- Face with lower portion mostly brownish; surstyli wider than long 10
10. Surstyli longer laterally than medially, ventrolateral edge angulate *L. huachuca*, new species
- Surstyli wider medially than laterally, ventrolateral edge broadly rounded *L. turneri*, new species

Limnellia anderssoni, new species

Figs. 2–5

Diagnosis.—Specimens of *L. anderssoni* are distinguished from those of congeners by the following characters: setulose portion of face mostly unicolorous, grayish brown; antennal fovea shallowly but distinctly im-



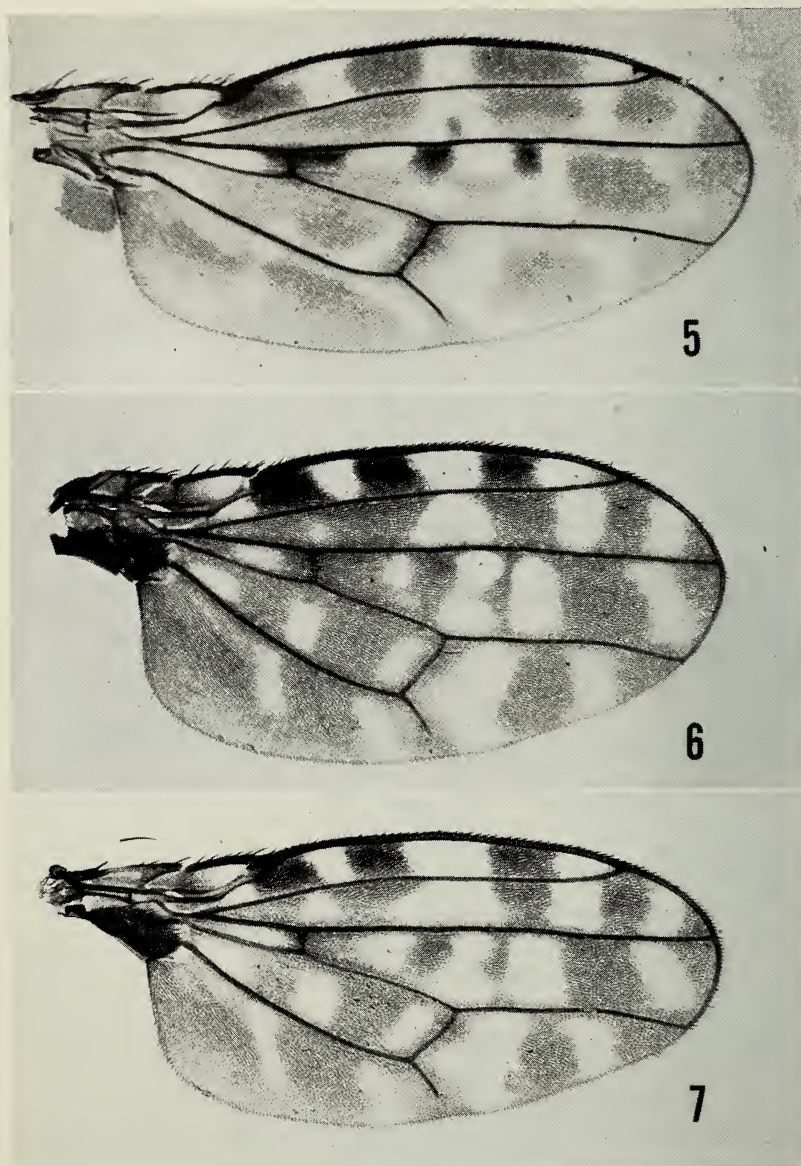
Figs. 2-4. *Limnellia anderssoni*: 2. Epandrium and surstyli, caudal view; 3. Aedeagus, lateral view; 4. Gonite, lateral view.

pressed; wing maculation pattern as in Fig. 5; basitarsi and halter pale, yellowish; male genitalia as in Figs. 2-4.

Description.—Small shore flies, length 1.86 mm (holotype).

Head: Head width-to-height ratio 1:0.59. Frons mostly brown, becoming darker, more charcoal colored laterally; mesofrons unicolorous; parafrons with anterior margin cinereous to grayish green, otherwise brown, concolorous with mesofrons. Face slightly arched transversely; interfoveal carina indistinct; antennal fovea shallowly impressed but distinct; lower portion of face grayish brown, becoming slightly darker near insertions of dorsomost setae; antennal fovea brown to cinereous, becoming more cinereous dorsally and laterally. Eye height-to-width ratio 1:0.86; eye-to-cheek ratio 1:0.15.

Thorax: Basitarsi and usually second and third tarsomeres of each leg pale, yellowish, contrasting distinctly with black tibiae. Wing maculation pattern (Fig. 5) as follows: cell R_1 with 3-4 white spots, basal one weakly developed, thin, brown areas subrectangular, becoming larger apically; cell R_3 with 2-3 white areas, white area aligned with posterior



Figs. 5-7. Wings. 5. *Limnellia anderssoni*; 6. *L. anna* (Great Smokey National Park, North Carolina); 7. *L. anna* (La Fayette, North Dakota).

crossvein with small brown spot within and close to vein R_{4+5} , apical spot larger and with larger brown spot within, the latter nearly equalling width of cell; cell R_5 with 2 darker brown spots, each closely appressed against vein R_{4+5} , with 2-3 white areas; discal cell with 2 white areas closer to posterior margin of cell, apical one transversely linear; cell M_2 with 2 white areas, basal one much larger, irregular in shape; cell M_4 with 2-4 white areas, sometimes subdivided. Wing length-to-width ratio 1:0.47; costal vein index 1:0.27; M_{1+2} index 1:0.54. Halter pale, yellowish.

Abdomen: Male genitalia (Figs. 2-4) as follows: epandrium (Fig. 2) in caudal view rounded dorsally, ventral margin narrowed distinctly; surstyli broadly semicircular in shape, symmetrical, setulose, slightly longer than wide; aedeagal apodeme closely attached with posterior portion of aedeagus; aedeagus with V-shaped notch dorsally and anteroventral, median prong.

Type-material.—Holotype male, labelled: "3 mi. SE. Auburn in El Dorado Co. Calif V-9-1965/ M. R. Gardner Collector." The holotype is in the National Museum of Natural History, Smithsonian Institution, type number 75473. The right wing has been removed and slide mounted; the postabdomen has been removed, dissected, and the parts placed in an attached microvial.

Geographic distribution.—This species is known only from the type-locality.

Relationship.—*Limnellia anderssoni* is closely related to *L. anna* as demonstrated by similarities of the male genitalia. The epandrium in males of both species is abruptly narrowed ventrally, forming a parallel-sided process to which the surstyli are attached. Each surstylus is broadly crescent shaped to semicircular.

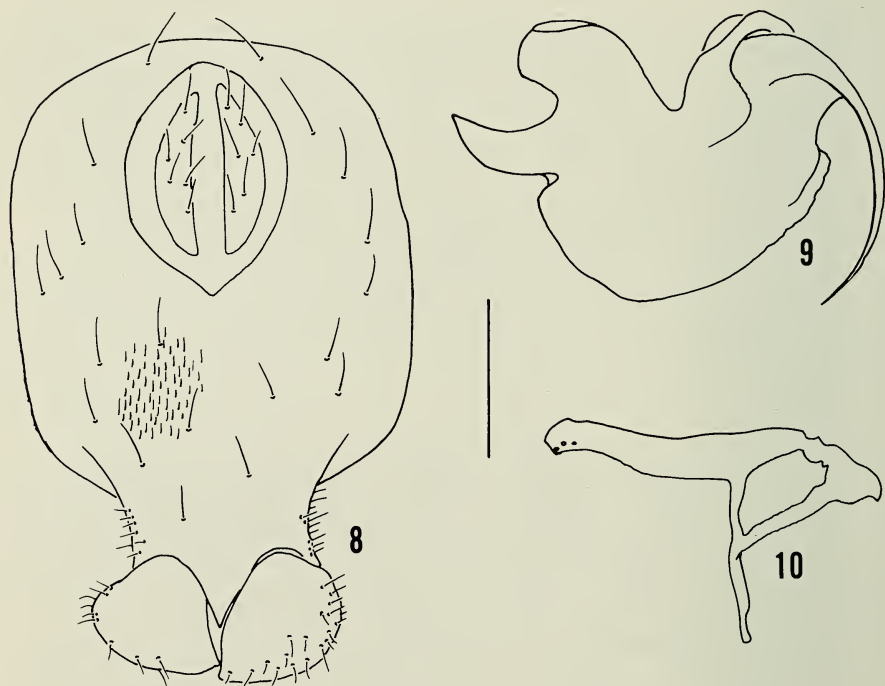
Etymology.—*Anderssoni* is a genitive patronym honoring Dr. Hugo Andersson, Zoological Institute, Lund, Sweden, for his outstanding contribution to the systematics of *Limnellia*.

Limnellia anna Cresson

Figs. 6-11

Limnellia anna Cresson, 1935:363 (review). Wirth, 1965:758 (catalogue).
Scatella (Limnellia) anna, Sturtevant and Wheeler, 1954:177 (review).

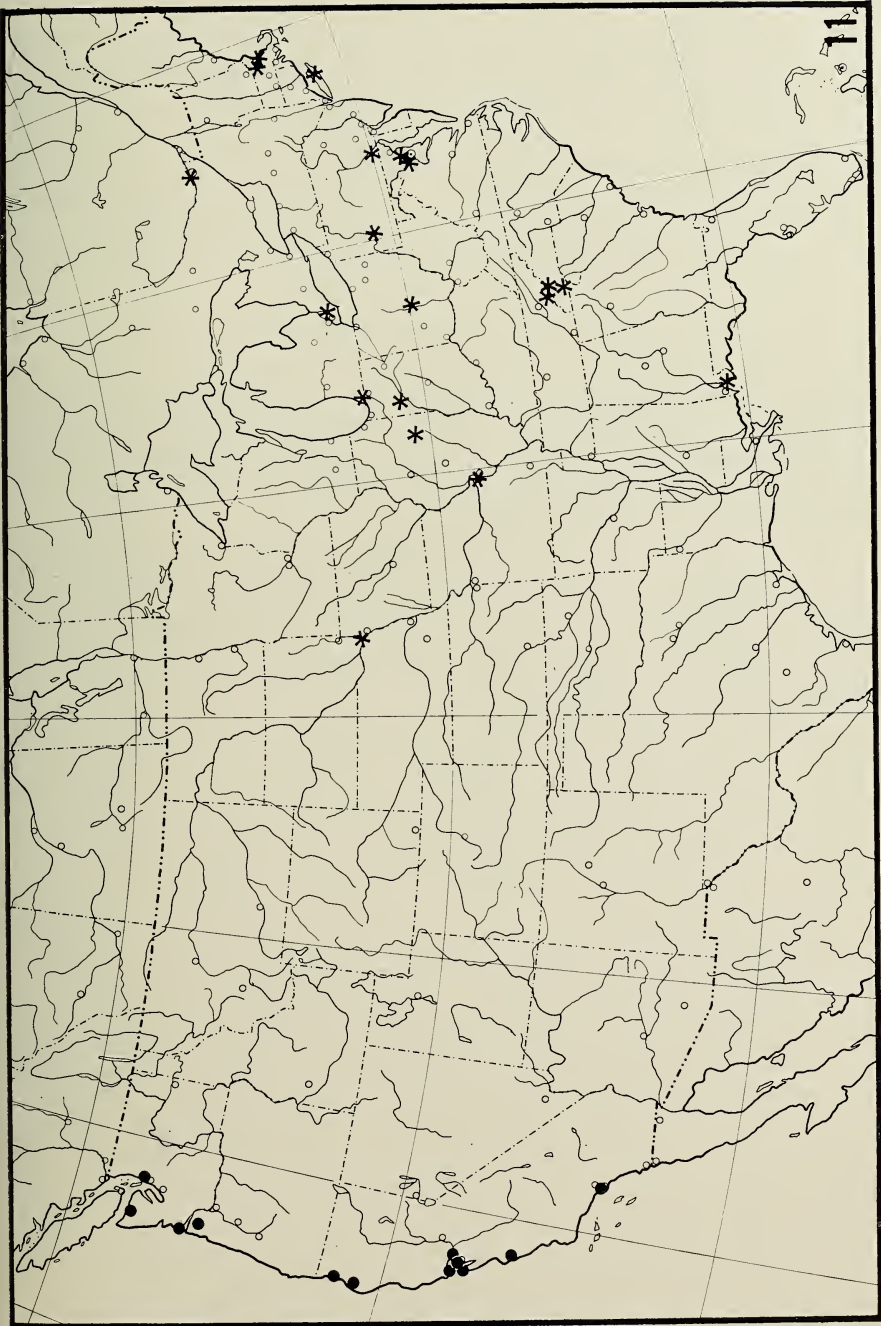
Diagnosis.—Specimens of *L. anna* are distinguished from those of congeners by the following characters: setulose portion of face with ventral margin pollinose, cinereous, bordered dorsally by a distinctly contrasting, dark brown band; antennal fovea shallowly impressed; costal vein index averaging 1:0.35; wing maculation pattern as in Figs. 6-7; tarsi of fore leg concolorous with tibia, those of mid and hind legs pale, yellowish; halter brownish yellow to blackish brown; male genitalia as in Figs. 8-10.



Figs. 8-10. *Limnellia anna*: 8. Epandrium and surstyli, caudal view; 9. Aedeagus, lateral view; 10. Gonite, lateral view.

Description.—Small shore flies, length 1.38-1.89 mm.

Head: Head width-to-height ratio averaging 1:0.62. Frons mostly brown to charcoal brown; anterior margin, wedge shaped area of parafrons, and spot anterolaterad of inner vertical bristle cinereous, contrasting distinctly with overall color of frons; small generally guttate areas laterad of ocellar triangle slightly lighter brown, sometimes with similar spot anterior of triangle. Face shallowly arched; interfoveal carina little evident; antennal fovea shallowly impressed; ventral margin of face cinereous, bordered dorsally with brown, transverse band which extends dorsally to dorsalmost facial setae; dorsad of brown band cinereous except for a brown area between and below antennae which is shaped like an inverted T. Eye height-to-width ratio averaging 1:0.91; eye-to-cheek ratio averaging 1:0.13.



Thorax: Fore basitarsus black, concolorous with fore tibiae; basitarsi of mid and hind legs pale, yellowish, contrasting with black tibiae. Maculation pattern of wing (Figs. 6–7) as follows: cell R_1 with 4 white spots; cell R_3 with 3–5 white spots, frequently basal spot is weak, sometimes second basal spot partially divided; cell R_5 with 4–5 white spots, second basal spot frequently partially or wholly divided; discal cell with 3 white spots, cell M_2 with 2 white spots, cell M_4 with 2 white spots. Wing length-to-width ratio averaging 1:0.52; costal vein index averaging 1:0.35; M_{1+2} vein index averaging 1:0.67. Halter brownish yellow to brownish black.

Abdomen: Male genitalia (Figs. 8–10) as follows: epandrium (Fig. 8) in caudal view rectangular-oval, ventral margin produced ventrally, forming narrower projection to which the surstyli are attached; surstyli symmetrical, frequently one or the other curved, appearing asymmetrical, broadly oval in conformation, setulose; aedeagus with anterior projection, V-shaped notch dorsally, broadly rounded ventrally; aedeagal apodeme distinguished from aedeagus as Y-shaped posterior process with each arm attached to posterior end of aedeagus.

Type-material.—Holotype male, labelled: “Boston XI. 6. 24. Mass/Greenhouses Bussey Inst. Forest Hills Kellogg/ M.C.Z. Type 25376 (red)/TYPE No. Linnellia ANNA ♂ E T Cresson, Jr.” The holotype and 2 female paratypes are in the Museum of Comparative Zoology, Harvard University, type number 25376. One male paratype is in the Academy of Natural Sciences of Philadelphia.

Specimens examined.—Forty-one specimens (6 ♂♂, 35 ♀♀). CANADA: Ontario: Chatham (1 ♀, CNC). Quebec: Old Chelsea (2 ♀♀, CNC), Summit King Mt., 1,150' (1 ♂, CNC); Wakefield (1 ♀, CNC). UNITED STATES: Alabama: Mobile Co., Kushla (1 ♀, USNM). Illinois: (1 ♀, ANSP); Champaign Co., Champaign (1 ♀, CNC), Urbana (2 ♀♀, ANSP). Indiana: Tippecanoe Co., Lafayette (1 ♀, USNM). Maryland: Montgomery Co., Colesville, malaise trap (1 ♂, 2 ♀♀, USNM). Massachusetts: Middlesex Co., Framingham (2 ♀♀, USNM); Suffolk Co., Boston (2 ♂♂, 4 ♀♀, ANSP, MCZ, USNM). Michigan: Berrien Co., Stevensville (1 ♀, USNM). Missouri: Saint Louis Co., St. Louis, 2 mi W (1 ♀, USNM). New York: Nassau Co., Long Island, Wantagh, liliun plant (8 ♀♀, USNM). North Carolina: Great Smoky Mountains National Park, New Foundland Ridge (2 ♀♀, USNM); Macon Co., Wayah Bald, 5,400' (1 ♂, CNC). Ohio: Franklin Co., Columbus (1 ♂, ANSP). Pennsylvania: Allegheny Co., Pittsburg (1 ♀, USNM); York Co., York, 13 mi W Conewago Creek (1 ♀, USNM). South Dakota: Union Co., Elk Point (1 ♀, USNM). Tennessee: Sevier Co., Great Smoky Mountains National Park, Gatlinburg, 4,900'—3D Heath Bald (1 ♀, USNM). Virginia: Fairfax Co., Dead Run (1 ♀, USNM).

Geographic distribution (Fig. 11).—The distribution of *L. anna* ranges over much of eastern North America, from Elk Point, South Dakota

(42°40'N, 96°40'W) in the northwest to Wakefield, Quebec (45°38'N, 75°96'W) in the northeast, and southward to St. Louis, Missouri (38°40'N, 90°15'W) in the southwest to Kushla, Alabama (30°80'N, 88°18'W) in the south, and to Wayah Bald, North Carolina (35°22'N, 83°70'W) in the southeast.

Natural history.—The type-series was collected in a greenhouse and other specimens have been taken from windows. Most specimens, however, were collected out-of-doors.

Relationship.—My comments under *L. anderssoni* apply here also.

Limmellia balioptera, new species

Figs. 12–17

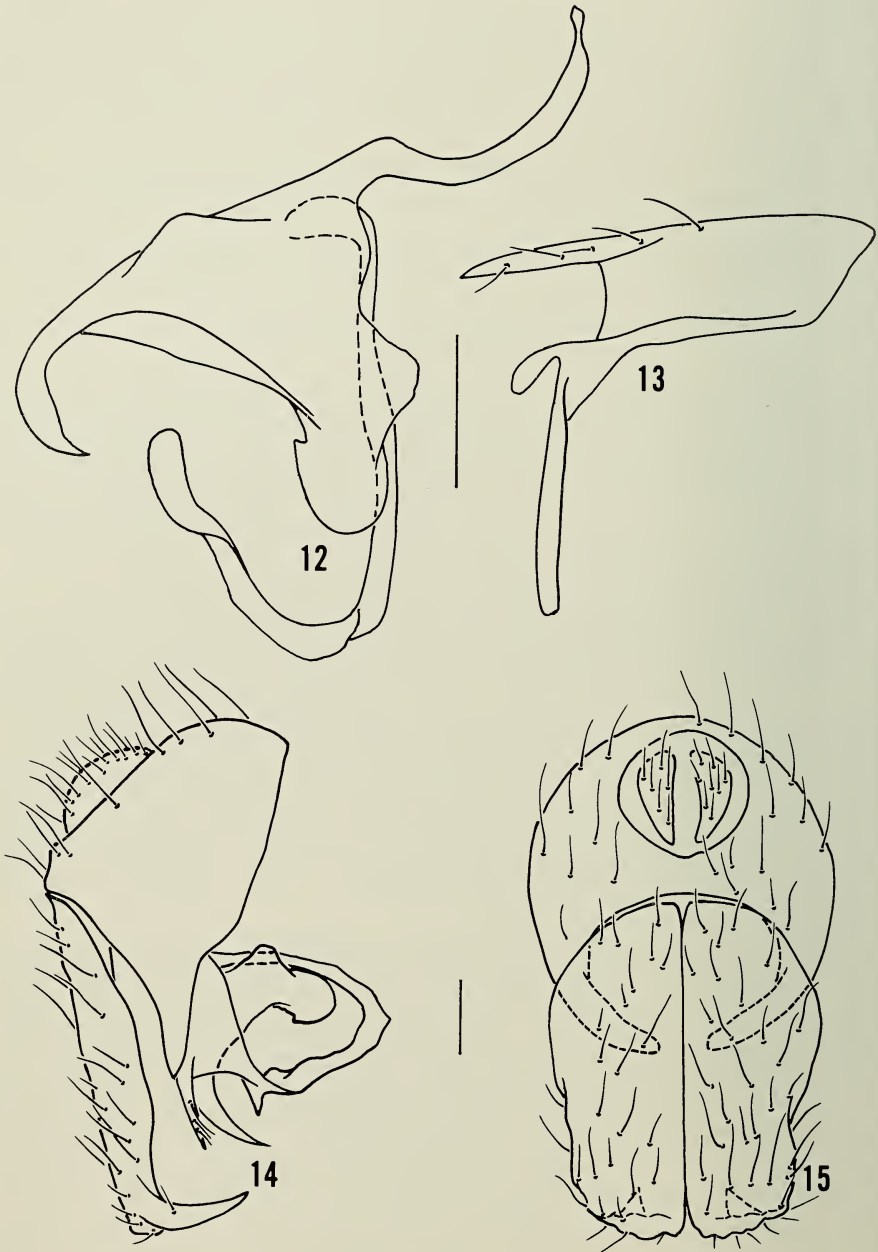
Diagnosis.—Specimens of *L. balioptera* are distinguished from those of congeners by the following characters: large species, length averaging 2.28 mm; setulose portion of face mostly unicolorous, grayish brown; antennal fovea shallowly but distinctly impressed; wing maculation pattern as in Figs. 16, 17; basitarsi of all legs and halteres concolorous, pale, yellowish; male genitalia as in Figs. 12–15.

Description.—Moderately-small shore flies, length 2.15–2.46 mm.

Head: Head width-to-height ratio averaging 1:0.58. Frons mostly brown to charcoal brown; mesofrons with faintly evident, vertical, yellowish-gray strip anteriorly, with lighter brown areas laterad of ocellar triangle; parafrons with anterior margins and thin strip near vertex cinereous, otherwise concolorous with mesofrons. Face mostly unicolorous, grayish brown; antennal fovea and area laterad becoming more grayish; shape of face nearly flat, very slightly arched transversely; interfoveal carina evident but not protruding distinctly; antennal fovea distinctly impressed although shallow. Eye height-to-width ratio averaging 1:1; eye-to-cheek ratio averaging 1:0.15.

Thorax: Basitarsi and usually second and third tarsomeres pale, yellowish, contrasting with black tibiae of each leg. Maculation pattern of wing (Figs. 16, 17) as follows: cell R_1 with 5–7 white spots, each clearly defined; cell R_3 with 4 white spots, spot at each end smaller and lacking clear definition, middle 2 white spots with brown spots completely surrounded by white coloration; cell R_5 with 4–5 white areas, middle white areas with darker brown spots, each surrounded by white; discal cell with 2–3 white areas, these better developed along posterior margin of cell; cell M_2 with 2 white areas, basal one larger and irregular in shape, sometimes subdivided; cell M_4 with 2–3 white areas, generally guttate. Wing length-to-width ratio averaging 1:0.47; costal vein index averaging 1:0.22; M_{1+2} vein index averaging 1:0.51. Halter yellowish.

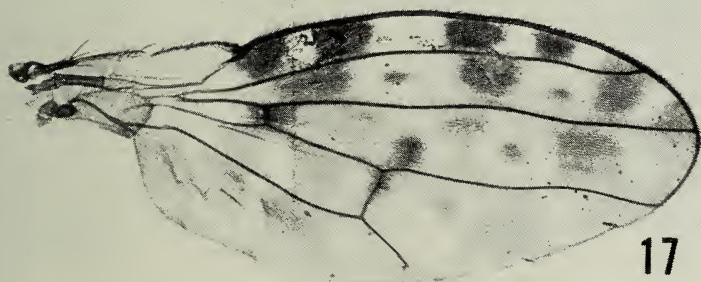
Abdomen: Male genitalia (Figs. 12–15) as follows: epandrium (Figs. 14, 15) short, rounded dorsally, wider than long in caudal view, anteroventral



Figs. 12-15. *Limnellia balioptera*: 12. Aedeagus, lateral view; 13. Gonite, lateral view; 14. Male genitalia, lateral view; 15. Epandrium and surstyli, caudal view.



16



17



18

Figs. 16-18. Wings. 16. *Limnellia balioptera* (23.2 mi S South Bend, Washington); 17. *L. balioptera* (Fields Springs State Park, Washington); 18. *L. huachuca*.

portions of each side drawn out, forming narrow processes enlarged, robust, each much longer than wide, apex curved posteriorly at right angle, becoming subulate (best seen in lateral view), setulose; aedeagus considerably modified, with curved, anterodorsal, acutely-pointed process and narrowly-rounded, ventral process, posterodorsal portion extends dorsally, attaching to anterior surface of surstyli; aedeagal apodeme as two linear processes which remain unfused until merger with apices of ventral gonapophyses, beyond merger as a single, slightly curved, bluntly-rounded process; gonite complicated (Fig. 13).

Type-material.—Holotype male, labelled: "WASH: Pierce Co. Mt. Rainier N. P., Van Trump Ck., 21 mi Above Christine Falls. VIII-13-1977 R. S. Zack Collr. (handwritten on black bordered label)." Allotype female and six male paratypes: with same locality data as holotype. Other paratypes as follows: Washington: 23.2 mi S South Bend, 9. X. 68, Mal(aise) Tr(ap) D. D. Munroe (1♀, CNC); Okanagan Co., 5 mi E Wauconda Rt. 30. VII. 7. 1972, W. J. Turner (1♀, WSU); Ilwaco, VI. 6. 18, A. Spuler (1♀, WSU). The holotype and allotype are in the James Entomological Collection, Washington State University, Pullman, type number 356; the male paratype from the type-locality is in the National Museum of Natural History, Smithsonian Institution.

Geographic distribution.—The distribution of *L. balioptera* is based on the six specimens listed above, all from the state of Washington.

Natural history.—Richard Zack, collector of the specimens from the type-locality, described the habitat as a wet, rocky area that was strewn with forest debris and through which water trickled. The rocks averaged about one foot in diameter and there was no apparent standing water.

Relationship.—This species is difficult to associate using characters of the male genitalia because they are substantially modified. Accordingly, I have depended more on the wing maculation pattern which resembles that of *L. sejuncta* specimens, to which I believe it is closely allied.

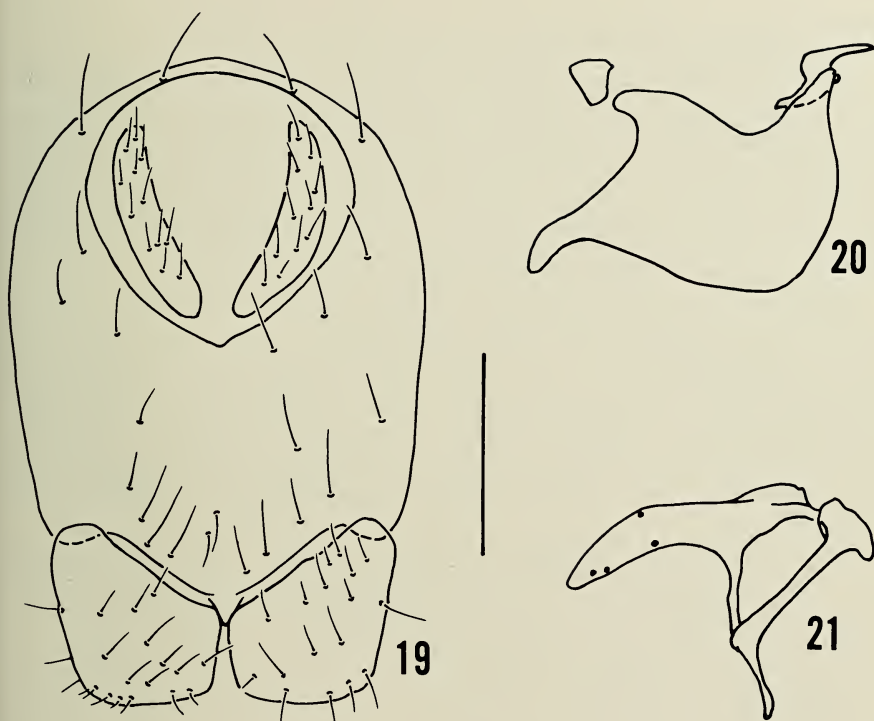
Etymology.—*Balioptera* is of Greek derivation and is a combination of the adjective *balios*, meaning "spotted" and the noun *pterum* (Gr. *pteron*), meaning "wing," in allusion to the spotted wings of this species. It is a compound adjective.

Limnellia huachuca, new species

Figs. 18-21

Diagnosis.—Specimens of *L. huachuca* are distinguished from those of congeners by the following characters: setulose portion of face mostly unicolorous, grayish brown; antennal fovea shallowly impressed; wing maculation and venation as in Fig. 18; basitarsi of all legs pale, yellowish; halteres brownish yellow; male genitalia as in Figs. 19-21.

Description.—Small shore flies, length 1.24-1.93 mm.



Figs. 19–21. *Limmellia huachuca*: 19. Epandrium and surstyli, caudal view; 20. Aedeagus, lateral view; 21. Gonite, lateral view.

Head: Head width-to-height ratio averaging 1:0.62. Frons generally brown to charcoal brown; mesofrons with faintly evident, vertical, cinereous vitta; parafrons with anterior margin cinereous, becoming more brownish in color posteriorly. Face in profile nearly flat, very slightly arched; interfoveal carina not evident; antennal fovea evident but shallowly impressed; ventral margin of face slightly cinereous, remaining area brownish gray, becoming more cinereous dorsally, lacking distinct banding sequence. Eye height-to-width ratio averaging 1:0.83; eye-to-cheek ratio averaging 1:0.11.

Thorax: Basitarsi plus second and third tarsomeres of each leg pale, yellowish, contrasting distinctly with black tibiae. Maculation pattern of wing (Fig. 18) as follows: cell R_1 with 6–7 white spots; cell R_3 with 4–5 white spots, frequently basal spot weakly developed; cell R_5 with 4 white spots, second basal white spot largest, with brown spot in center; discal cell with 3 white spots; cell M_2 with 2 white spots; cell M_4 with 2 spots, one or the other frequently weakly developed. Wing length-to-

width ratio averaging 1:0.46; costal vein index averaging 1:0.25; M_{1+2} vein index averaging 1:0.53. Halter brownish yellow.

Abdomen: Male genitalia (Figs. 19–21) as follows: epandrium (Fig. 19) in caudal view oval dorsally, becoming subtruncate ventrally, forming a broadly based triangular process between attachments of surstyli; surstylus truncate ventrally, quadrate except for lateral margin which extends dorsally further than median margin, setulose; aedeagus (Fig. 20) generally subquadrate but with extending anterior and posterior processes; aedeagal apodeme indistinguishable from aedeagus.

Type-material.—Holotype male, labelled: "Ramsey Cyn. 6000' 15 mi. S. Sierra Vista Huachuca Mts. ARIZ. Sternitsky 18. V. 67." Allotype female and 18 paratypes (9♂♂, 9♀♀, CNC, USNM): with same label data as holotype except for dates which are from 13 April to 13 August, 1967. Other paratypes as follows: Arizona: Cochise Co., Chiricahua Mts. (1♂, 2♀♀, USNM). The holotype, allotype, and most of the paratypes from the type-locality are in the Canadian National Collection, Ottawa, type number 15433.

Other specimens examined.—UNITED STATES: Arizona: Cochise Co., Herb Matyr Park (1♂, WNM); Portal-Southwest Research Station, malaise trap (1♀, USNM). Pima Co., Greaterville (1, CAS).

Geographic distribution.—This species is known only from Cochise and Pima counties in southern Arizona.

Relationship.—Apparently *L. huachuca* is closely allied with *L. turneri*. The surstyli of males of both species are wider than long, the aedeagal conformations are similar, and the whole genital complex of each is relatively smaller.

Etymology.—According to Barns (1960) *huachuca* was apparently used first for a Pima Indian village located in what is now Cochise County, Arizona. The name was later applied to a historic U.S. Army post and to a range of mountains in southern Arizona, where the type series was collected. As a species name it is a noun in apposition.

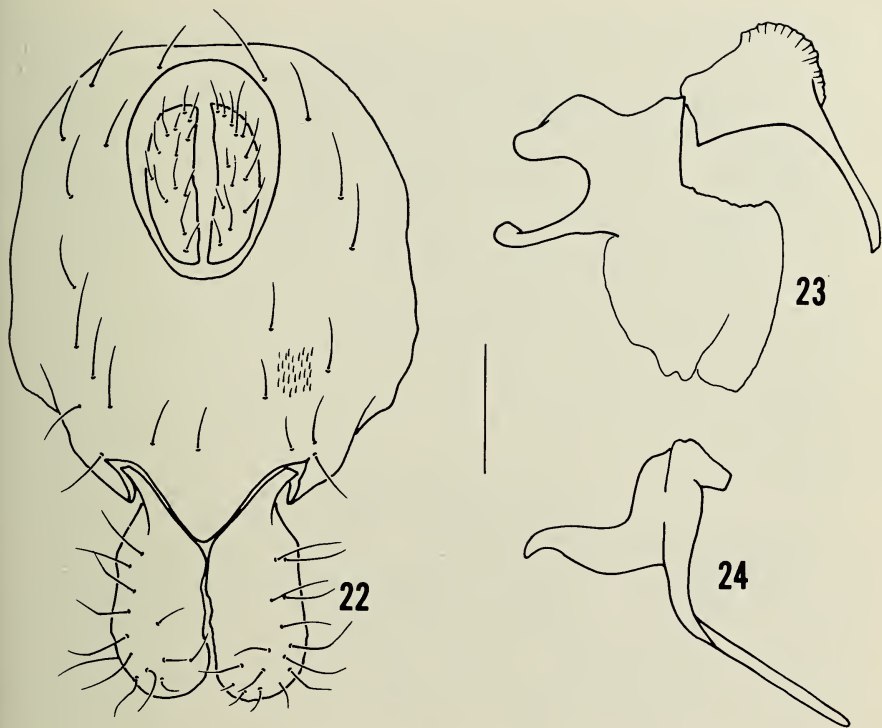
Linnellia lactea, new species

Figs. 22–25

Diagnosis.—Specimens of *L. lactea* are distinguished from those of congeners by the following characters: setulose portion of face mostly unicolorous, lacteus but with small median and lateral areas slightly darker, lacteus brown; antennal fovea very shallowly impressed; wing maculation pattern as in Fig. 25; basitarsi of all legs pale, yellowish, contrasting with black tibial coloration; halter brownish yellow to brown; male genitalia as in Figs. 22–24.

Description.—Small shore flies, length 1.55–1.94 mm.

Head: Head width-to-height ratio averaging 1:0.62. Frons color vary-



Figs. 22-24. *Limnellia lactea*: 22. Epandrium and surstyli, caudal view; 23. Aedeagus, lateral view; 24. Gonite, lateral view.

ing from light grayish green to charcoal brown, lateral margins generally darker; mesofrons generally brown but with anteromedian, light grayish-green areas and 2 lighter brown spots laterad of ocellar triangle; parafrons mostly unicolorous, charcoal brown; fronto-orbital plates not generally discernable. Face weakly arched transversely; interfoveal carina evident but weakly developed; antennal fovea very shallowly impressed; facial color nearly unicolorous, mostly lacteus, especially antennal fovea and laterad, setulose portion with some darker, more brownish areas. Eye height-to-width ratio averaging 1:0.88; eye-to-cheek ratio averaging 1:0.12.

Thorax: Basitarsi and generally second and third tarsomeres of each leg pale, yellowish, contrasting with black tibiae. Wing maculation pattern (Fig. 25) as follows: cell R_1 with 6 white spots, those at each end tending to be smaller and less definite; cell R_3 with 2 white areas apicad of alignment of posterior crossvein, apical one with brown spot which is closely appressed to apex of vein R_{2+3} ; cell R_5 with 2-3 white areas, frequently basal one partially subdivided, with 2 darker brown spots, each closely



Figs. 25-27. Wings. 25. *Limnellia lactea*; 26. *L. lecocercus*; 27. *L. sejuncta*.

appressed to vein R_{4+5} ; discal cell with 2-3 white areas, more closely associated with vein M_{3+4} ; cell M_2 with 2 white spots, basal one much larger and tending to be irregular; cell M_4 with 2-4 white areas, median ones sometimes subdivided. Wing length-to-width ratio averaging 1:0.48; costal vein index averaging 1:0.24; M_{1+2} vein index averaging 1:0.56. Halter yellowish brown to brown.

Abdomen: Male genitalia (Figs. 22-24) as follows: epandrium (Fig. 22) in caudal view slightly longer than wide, rounded dorsally, obtusely angulate ventrally; surstyli nearly twice as long as wide, bluntly rounded apically, attached but not indistinguishably with ventral margin of epandrium at lateral margins of ventromedian, epandrial process, setulose; aedeagus deeply emarginate anteriorly in profile, ventral prong slightly longer than dorsal one; venter becoming less sclerotized, membranous, irregular but generally rounded; aedeagal apodeme attached laterally with posterior portion of aedeagus, posterodorsal margin forming slightly crenulate ridge, ventrally extending process attached ventrally with gonol process from each side.

Type-material.—Holotype male, labelled: "Rustler Park Ariz. 6-11-51 (handwritten)/A. H. Sturtevant Collection, 1970." Allotype female and 2 paratypes (1♂, 1♀), labelled: "ARIZ. Graham Co. Hospital Flat Pinaleno Mts. Alt. 8950' 2.VIII.1965 Hugh B. Leech." The holotype is in the National Museum of Natural History, Smithsonian Institution, type number 75474. The allotype and other paratypes are in the California Academy of Sciences, San Francisco. The postabdomen of the holotype has been removed, dissected, and placed in an attached microvial; the left wing of the female paratype was removed and slide mounted.

Geographic distribution.—The known distribution of *L. lactea* is limited to southwestern Arizona.

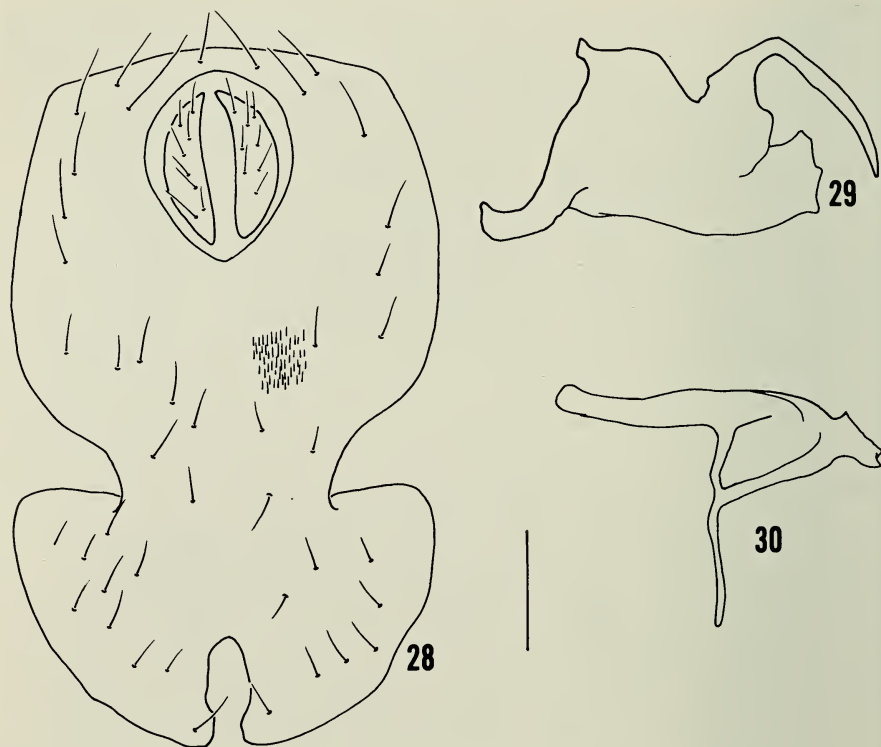
Relationship.—I have placed this species near *L. stenhammari*, although there is little confirming evidence. The epandrium and surstyli of both species are similar, but whether these character states are synapotypic has not been determined.

Etymology.—*Lactea* is a Latin adjective meaning "milky," in allusion to the milky-colored face of specimens of this species.

Linnellia lecocercus, new species

Figs. 26, 28-30

Diagnosis.—Specimens of *L. lecocercus* are distinguished from those of congeners by the following characters: setulose portion of face unicolorous, golden brown to grayish brown; antennal fovea shallowly impressed; wing maculation pattern as in Fig. 26; basitarsi of all legs concolorous with tibiae; halter brownish yellow; male genitalia as in Figs. 28-30.



Figs. 28-30. *Limnellia lecocercus*: 28. Epandrium and surstyli, caudal view; 29. Aedeagus, lateral view; 30. Gonite, lateral view.

Description.—Small shore flies, length 1.73-1.86 mm.

Head: Head width-to-height ratio averaging 1:0.51. Frons mostly unicolorous, brown to charcoal brown, becoming darker laterally, anterior margin of parafrons bordered with cinereous color. Face weakly arched; interfoveal carina weakly developed but evident; antennal fovea distinct but shallowly impressed; color generally brown to grayish brown, becoming lighter and grayer dorsally, this especially evident laterad of antennal fovea. Eye height-to-width ratio averaging 1:0.97; eye-to-cheek ratio averaging 1:0.17.

Thorax: Legs unicolorous, entirely black, occasionally with some surfaces more pollinose, slightly cinereous. Wing maculation pattern (Fig. 26) as follows: cell R_1 with 4-5 white spots, frequently spots at either end of cell weakly developed; cell R_3 with 3-4 white spots, if fourth present, weakly developed; cell R_5 with 4 white spots and with 2 darker brown spots along anterior margin of cell, each closely appressed to vein R_{4+5} ; discal cell with 2 white spots; cell M_2 with 2 white spots; cell M_4 with 2 white

spots. Wing length-to-width ratio averaging 1:0.5; costal vein index averaging 1:0.27; M_{1+2} vein index averaging 1:0.65. Halter brown to brownish black.

Abdomen: Male genitalia (Figs. 28–30) as follows: epandrium (Fig. 28) in caudal view angulate dorsally, deeply incised just below what appears to be the middle of genital plate (combined epandrium and surstyli); surstyli broadly produced laterally, explanate, fused dorsally together and with ventral margin of epandrium, both surstyli together forming semi-circular plate which is deeply notched medially at ventral margin; aedeagus in profile (Fig. 29) longer than wide, with V-shaped notch along dorsum; aedeagal apodeme attached to posterior portion of aedeagus and extending ventrally.

Type-material.—Holotype male, labelled: "Robson, B. C. 3-IX-1949 H. R. Foxlee." Allotype female: with same label data as holotype except for the date which is "31. VIII. 1948." One female paratype as follows: Alaska, Anchorage, June, 1964, K. M. Sommerman. The holotype and allotype are in the Canadian National Collection, Ottawa, type number 15434; the paratype is in the National Museum of Natural History, Smithsonian Institution. The left wing of the holotype has been removed and slide mounted; the postabdomen has been dissected, the parts are in an attached microvial.

Geographic distribution.—The known range of *L. lecocercus* lies between 49° and 61° north latitude along the West Coast of North America and the mountains just inland.

Relationship.—*Limnellia lecocercus* is probably the sister species of *L. anna* and *L. anderssoni*. Males of these three species have a constricted ventral margin of the epandrium; but the surstyli of the former are substantially and uniquely modified as described above.

Etymology.—*Lecocercus* is formed from the Greek nouns *lekos* (Latin transcription *lecos*), meaning "plate," and *kerkos* (Latin transcription *cercus*), meaning "tail," in allusion to the platelike surstyli of the male postabdomen of specimens of this species. The specific epithet stands as a noun in apposition to the generic name.

Limnellia sejuncta (Loew)

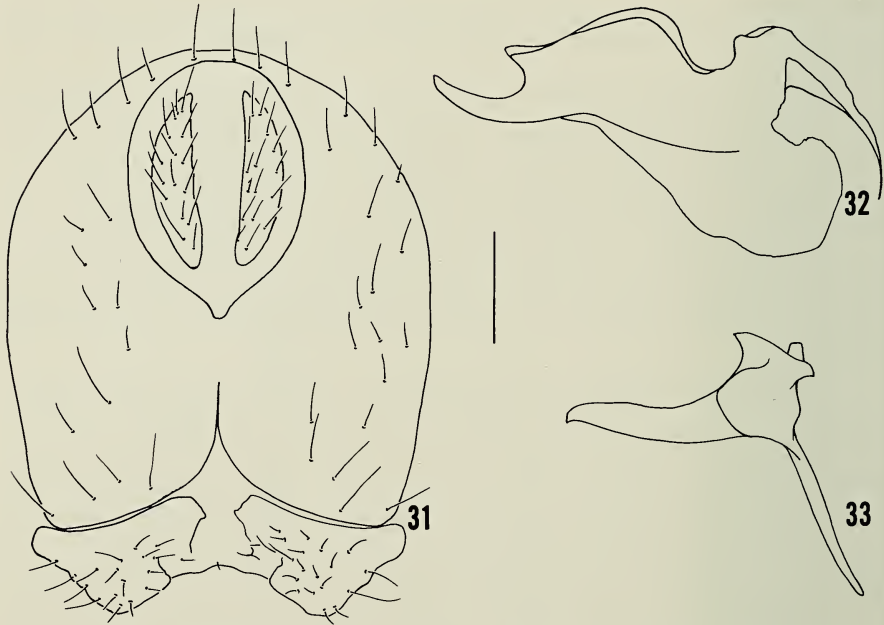
Figs. 11, 27, 31–33

Scatella sejuncta Loew, 1863:326. Osten Sacken, 1878:204 (catalogue).—Aldrich, 1905:631 (catalogue).

Limnellia sejuncta, Cresson, 1935:364 (review). Wirth and Stone, 1956:474 (review).—Wirth, 1965:758 (catalogue).

Scatella (*Limnellia*) *sejuncta*, Sturtevant and Wheeler, 1954:177 (review).

Diagnosis.—Specimens of *L. sejuncta* are distinguished from those of congeners by the following characters: setulose portion of face unicolorous,



Figs. 31-33. *Limmellia sejuncta*: 31. Epandrium and surstyli, caudal view; 32. Aedeagus, lateral view; 33. Gonite, lateral view.

golden brown to grayish brown; antennal fovea shallowly impressed, but more deeply so than in *L. ana*; wing maculation pattern as in Fig. 27; basitarsi of all legs pale, yellowish; halter brownish yellow to brown; male genitalia as in Figs. 31-33.

Description.—Small to moderately-small shore flies, length 1.46-2.19 mm.

Head: Head width-to-height ratio averaging 1:0.47. Frons generally unicolorous, brown to charcoal brown except for small cinereous areas along anterior margin of parafrons, color generally darker toward lateral margins. Third antennal segment with posteroventral portion tending to be paler, yellowish, especially as viewed from some angles. Face weakly arched transversely; interfoveal carina feebly developed but evident; antennal carina distinct but weakly impressed; facial color brown or grayish brown ventrally, becoming more cinereous dorsally, particularly antennal fovea and laterad. Eye height-to-width ratio averaging 1:0.94; eye-to-cheek ratio averaging 1:0.14.

Thorax: Basitarsi and frequently second tarsomeres pale, yellowish, contrasting distinctly with black tibiae of each leg. Wing maculation pattern (Fig. 27) as follows: cell R_1 with 4-5 white spots, basal spot generally weakly developed; cell R_3 with 2-3 white spots, both larger spots with

distinct brown spot in middle, surrounded by white color; cell R_5 with 3–4 white spots, frequently 1 or 2 spots indistinct or tending to be fused together, 2 darker brown spots within white spots and not touching any veins; discal cell with 2–3 spots, none distinctly developed; cell M_2 with 2 white areas, basal one usually Z-shaped; cell M_4 with 2 white spots, basal one sometimes constricted medially, appearing as 2 spots. Wing length-to-width ratio averaging 1:0.45; costal vein index averaging 1:0.19; M_{1+2} vein index averaging 1:0.56. Halter brownish yellow to brown.

Abdomen: Male genitalia (Figs. 31–33) as follows: epandrium (Fig. 31) in caudal view nearly as wide as long, rounded dorsally, emarginate ventrally; surstyli weakly fused medially, each wider than long, projecting as broadly angulate, shallow process; aedeagus large, longer than wide in profile, anterior tip curved, emarginate dorsally; aedeagal apodeme evident as slender process at posterior end of aedeagus.

Type-material.—Loew's original description (1863) states that the holotype is a female specimen collected from Sitka (Alaska) by Sahlberg. I have not located this specimen despite several inquiries and two visits to the Museum of Comparative Zoology, Harvard University, where Loew's types of New World Diptera are deposited. Apparently Cresson (1935) was likewise unsuccessful in finding the type, as his concept of this species was based on California specimens only. Perhaps it is significant, moreover, that Clausen and Cook (1971) did not find the type(s) of a second ephydrid species, *Parydra varia*, which Loew described in the same paper.

Specimens examined.—Fifty-one specimens (24♂♂, 27♀♀). UNITED STATES: California: Strawberry Canyon (1♂, CNC). Alameda Co., Alameda (1♀, CAS), Berkeley (7♂♂, 7♀♀, USNM), Berkeley Hills (4♂♂, 3♀♀, ANSP), Berkeley Hills-Tilden Park (1♂, CAS). Contra Costa Co., Antioch (1♀, CAS), Lafayette (1♂, CNC). Humboldt Co., Dyerville (1♀, USNM), Orick (1♂, USNM). Los Angeles Co., Whittier (1♂, USNM). Marin Co., Black Point (1♀, USNM), Inverness (1♂, CNC), Lily Pond, Alpine Lake, 1,500' (1♂, 1♀, CNC), Mill Valley (2♂♂, CAS), Muir Woods (1♂, 3♀♀, USNM), Redwood Canyon (1♀, ANSP). Monterey Co., Lucia (1♂, 1♀, USNM). San Francisco Co., San Francisco (4♀♀, CAS, USNM). Oregon: Wahkenna Falls (1♀, USNM). Clatsop Co., Astoria (1♀, WNM). Washington: Clallam Co., Kalaloch-Olympic National Park (1♀, USNM). Pacific Co., Ilwaco (1♂, USNM). Snohomish Co., Everett (1♂, USNM).

Geographic distribution (Fig. 11).—The known distribution of *L. sejuncta* ranges throughout the coastal region of western North America between 34° (Whittier, California) and 57° (Sitka, Alaska) north latitude.

Relationship.—My comments under *L. balioptera* apply here also.

Remarks.—I have accepted Cresson's (1935) concept of this species, realizing that I could be perpetuating an error. Specimens Cresson determined as this species match Loew's description well.

Linnellia stenhammari (Zetterstedt)

Figs. 34-40

Ephydra stenhammari Zetterstedt, 1846:1842.*Ephydra oscitans* Walker, 1849:1106. Osten Sacken, 1858:84 (catalogue)

NEW SYNONYMY.

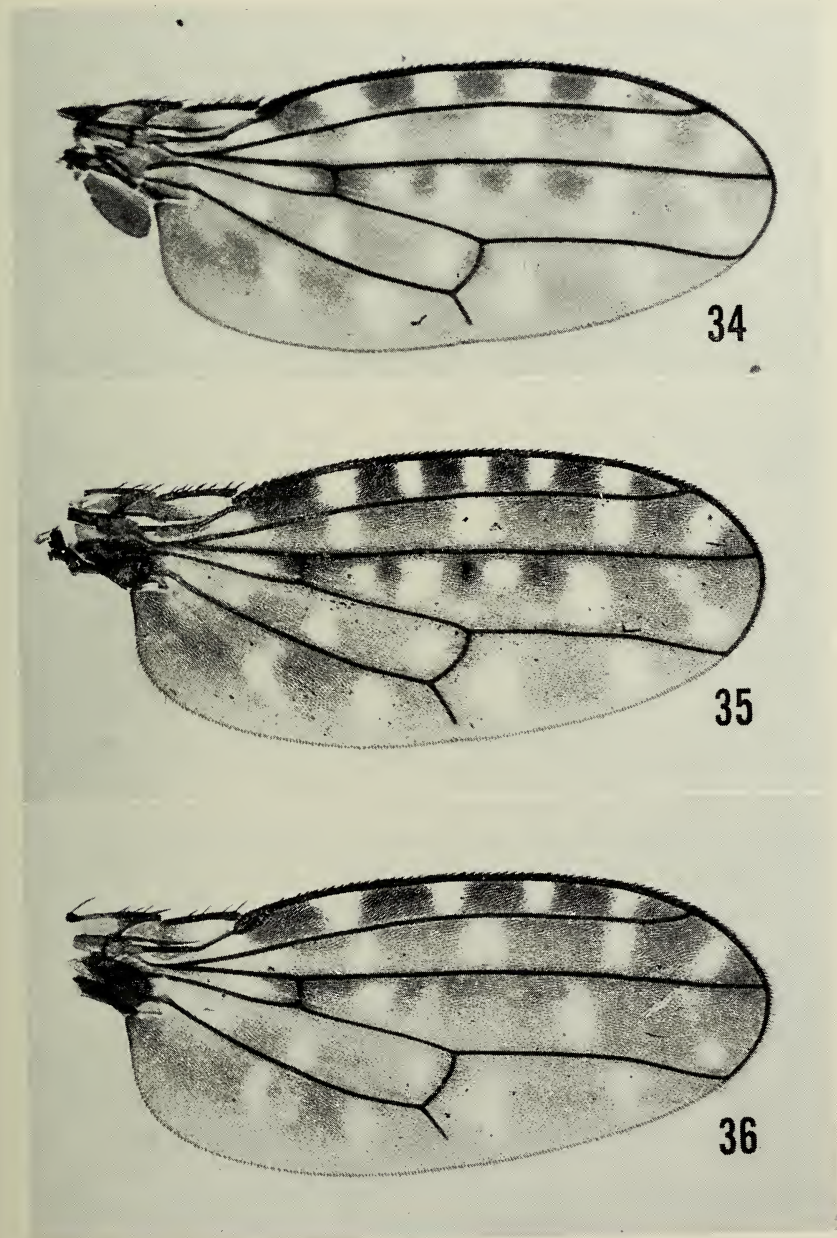
Scatella stenhammari, Loew, 1860:40. Osten Sacken, 1878:204 (catalogue).—Aldrich, 1905:631 (catalogue).*Scatella oscitans*, Osten Sacken, 1878:204 (catalogue). Aldrich, 1905:630 (catalogue).*Eustigoptera stenhammari*, Cresson, 1930:128 (review).*Linnellia stenhammari*, Cresson, 1935:363. Wirth, 1965:758 (catalogue).*Stranditella stenhammari*, Duda, 1942:30 (review).*Scatella (Linnellia) stenhammari*, Sturtevant and Wheeler, 1954:177 (review).*Linnellia oscitans*, Wirth, 1965:758 (catalogue).

Diagnosis.—Specimens of *L. stenhammari* are distinguished from those of congeners by the following characters: setulose portion of face mostly unicolorous, brown to grayish brown, occasionally with faintly colored, cinereous band along ventral margin; antennal fovea shallowly impressed, but more so than in *L. anna*; wing maculation pattern as in Figs. 34-36; basitarsi of all legs concolorous with tibiae, black; halter brownish yellow to black; male genitalia as in Figs. 37-39.

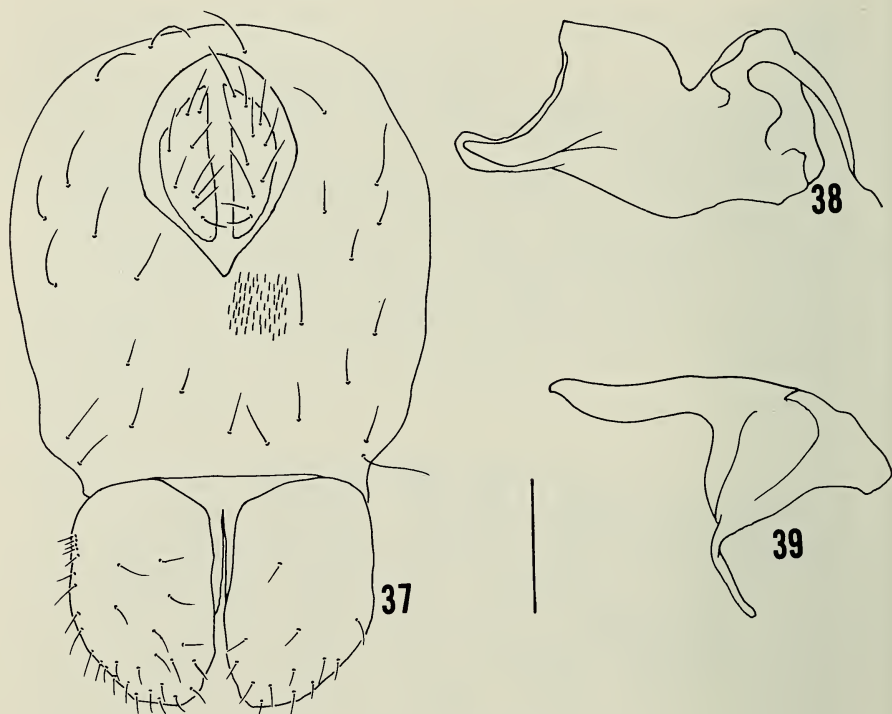
Description.—Small to moderately-small shore flies, length 1.57-2.23 mm.

Head: Head width-to-height ratio averaging 1:0.58. Frons generally brown, becoming darker, more charcoal colored laterally; parafrons with anterior margin and linear strip near vertex cinereous. Face weakly arched transversely; interfoveal carina evident but weakly developed; antennal fovea distinct but weakly impressed; facial color with extreme ventral margin slightly cinereous along with antennal fovea, otherwise brown to golden brown, brown color slightly more lustrous than that of frons. Eye height-to-width ratio averaging 1:0.91; eye-to-cheek ratio averaging 1:0.12.

Thorax: Legs generally unicolorous, brownish black to black. Wing maculation pattern (Figs. 34-36) as follows: cell R_1 with 4-5 white spots, each more or less clearly defined; cell R_3 with 4-5 white spots, those at either end tending to be weaker; cell R_5 with 4-6 white spots, apical one sometimes divided medially, generally with 3, occasionally with 2 darker brown spots, each closely appressed against vein R_{4+5} ; discal cell with 3 white spots; cell M_2 with 2 spots, basal one elongate, sometimes subdivided; cell M_4 with 2 white spots. Wing length-to-width ratio averaging 1:0.44; costal vein index averaging 1:0.21; M_{1+2} vein index averaging 1:0.67. Halter brownish yellow to brownish black.



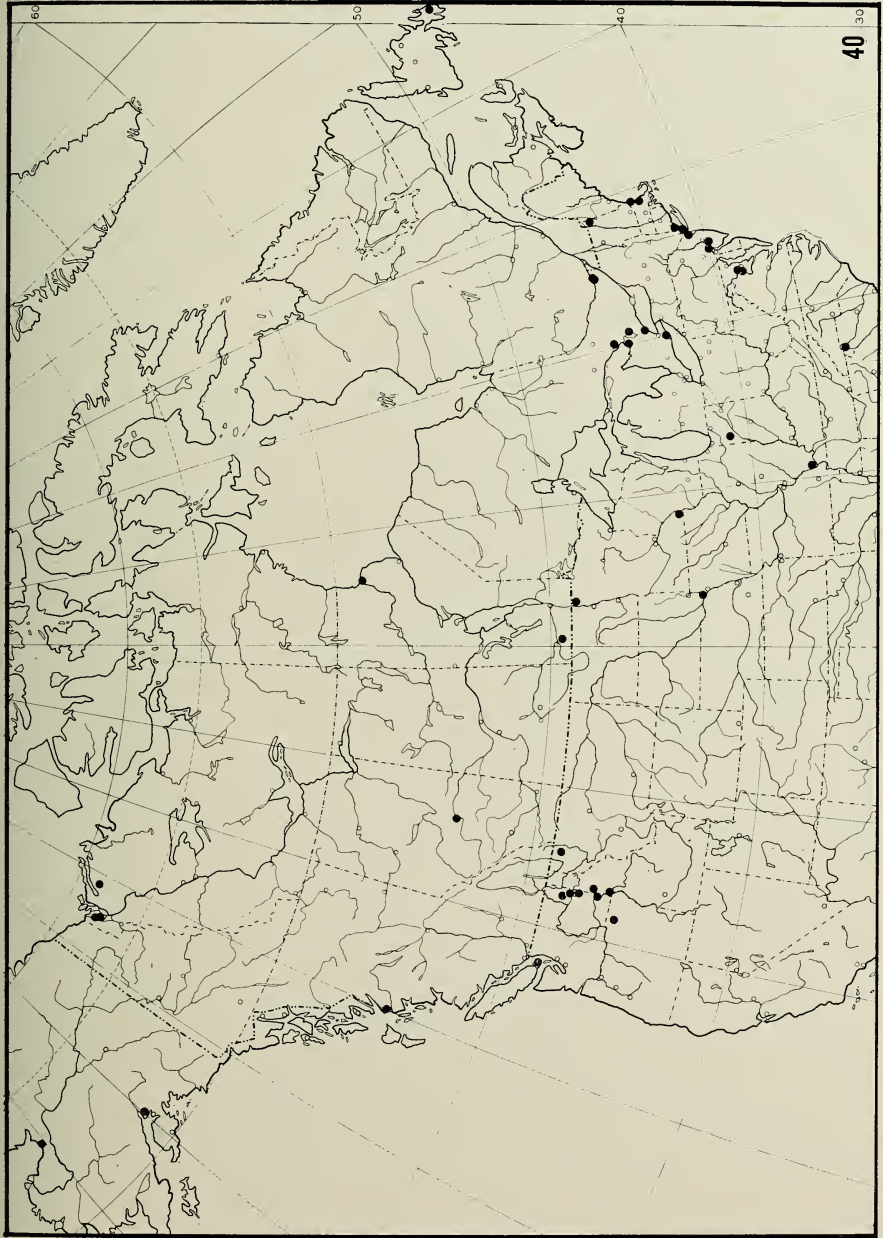
Figs. 34-36. Wings. 34. *Limnellia stenhammari* (Sweden); 35. *L. stenhammari* (Belfountain, Ontario); 36. *L. stenhammari* (Dune Park, Indiana).



Figs. 37-39. *Limnellia stenhammari*: 37. Epandrium and surstyli, caudal view; 38. Aedeagus, lateral view; 39. Gonite, lateral view.

Abdomen: Male genitalia (Figs. 37-39) as follows: epandrium (Fig. 37) in caudal view longer than wide, rounded dorsally, truncate ventrally; surstyli large, generally subrectangular, posterolateral margin rounded, setulose, not fused indistinguishably with ventral margin of epandrium; aedeagus longer than wide, with a V-shaped notch dorsally; aedeagal apodeme as a slender process attached to posterior end of epandrium.

Type-material.—Lectotype female, designated by Andersson (1971); Sweden, Skåne, Mellby, Esperöd. The lectotype is in Zetterstedt's Diptera Scandinaviae collection at the Zoological Institute, Lund University, Sweden. Junior synonym, sex unknown, labelled: "Type (green bordered circle)/ *Ephydra oscitans* Walk (handwritten)/ Hudson's Bay St. Martin's Falls. George Barnston, B. M. 1844 — 17 (handwritten)." The specimen is double mounted on a celluloid square; the abdomen, one-half to two-thirds of each wing, and both third antennal segments are missing.



Specimens examined.—Ninety-five specimens (39♂♂, 56♀♀). CANADA: Alberta: Edmonton (1♂, USNM). British Columbia: Prince Rupert (1♀, CNC). Manitoba: Aweme (1♀, CNC); Churchill (1♂, 3♀♀, CAS, CNC, USNM); Treesbank (1♂, 5♀♀, CNC, USNM). Newfoundland: Colinet (2♀♀, CNC). Northwest Territories: Aklavik (5♂♂, 9♀♀, CAS, CNS, USNM); Hyndman Lake—68°15'N, 131°03'W (1♂, CNC); Reindeer Depot—Mackenzie Delta (1♂, CNC). Ontario: Belfountain (1♀, USNM); Midland (1♂, 1♀, CNC); Ottawa (1♂, 1♀, CNC); Simcoe (1♀, CNC); Stittsville (1♀, CNC); Toronto (1♀, USNM); Waubamic—Parry Sound (1♂, 2♀♀, ANSP, USNM). Quebec: Breckenridge (1♂, CNC); Harrington Lake—Gatineau Park (1♂, CNC); Mistassini (1♀, CNC); Montreal (1♀, AMNH); Old Chelsea—Summit King Mountain (1♀, CNC); Rigaud (1♂, MCZ). Saskatchewan: Saskatoon (1♂, CNC). UNITED STATES: Alaska: Lower Tonsina (1♀, WNM); Matanuska (4♂♂, 3♀♀, USNM); Savonoski—Naknek Lake (1♂, CAS); Unalakleet (1♀, CNC). Connecticut: Fairfield Co., Redding (1♀, USNM). Idaho: Latah Co., Bovill (1♀, USNM); Moscow Mountain (2♂♂, ANSP, USNM); Potlatch (1♂, USNM). Nez Perce Co., Waha (1♀, USNM). Illinois: Union Co., Dongola (1♀, ANSP). Indiana: Dune Park (1♂, USNM). Tippecanoe Co., Lafayette (1♂, 1♀, USNM). Maryland: Montgomery Co., Cabin John (2♂♂, USNM); Plummer Island (1♂, USNM). Massachusetts: Essex Co., Beverly (1♂, USNM). Suffolk Co., Boston (1♂, USNM). Minnesota: Houston Co., (1♀, UMI). Kittson Co., (1♀, UMI). Montana: Glacier Co., Glacier National Park—Avalanche Lake (1♀, USNM). New Hampshire: Coos Co., Mt. Washington—cow pasture, 5,700' (1♂, CNC). New Jersey: Camden Co., Clementon (1♀, MCZ). Essex Co., Newark (1♂, MCZ). New York: New York (1♀, USNM). North Carolina: Summit of Black Mountains (1♂, AMNH). Oregon: Umatilla Co., Fly Creek Valley—on snow (1♀, WNM). Pennsylvania: Delaware Co., Swarthmore (2♂♂, ANSP). Philadelphia Co., Germantown (1♂, ANSP). South Carolina: Greenville Co., Greenville (1♀, USNM). South Dakota: Union Co., Elk Point (1♀, USNM). Virginia: Fairfax Co., Falls Church (1♂, MCZ). Washington: San Juan Co., Mt. Constitution (2♂♂, ANSP, USNM). Spokane Co., Deer Park (1♂, 1♀, USNM, WNM). Stevens Co., 3 mi NE Deer Lake (1♀, WNM). Whitman Co., Pullman (1♂, 3♀♀, ANSP, USNM). Valley Ford (1♂, USNM).

Geographic distribution (Fig. 40).—The distribution of *L. stenhammari* ranges throughout the Holarctic Region (Andersson, 1971; Miyagi, 1977; Wirth, 1965). In North America, it is widespread, occurring throughout Canada and Alaska and southward into the northern portions of continental United States. I have not examined any specimens south of South Carolina in the East, Indiana in the Midwest, or Oregon in the West.

Relationship.—See my comments under *L. lactea*.

Remarks.—I did not examine the lectotype of this species but feel con-

ident that the name has been applied correctly. Careful comparison was made with figures of the male genitalia and of the wing maculation pattern, illustrated by Andersson (1971), who designated the lectotype.

The only clues to the identity of the holotype of the junior synonym are the dark tarsomeres which are generally black dorsally, and the type-locality, which is well within the range of *L. stenhammari*. Because the holotype is badly damaged and because there is only one species known from the type-locality with dark tarsomeres, I have elected to recognize the type as conspecific with *L. stenhammari*.

Limnellia sticta, new species

Figs. 41–44

Diagnosis.—Specimens of *L. sticta* are distinguished from those of congeners by the following characters: setulose portion of face mostly grayish brown; antennal fovea shallowly impressed, but more so than in *L. anna*; wing maculation pattern as in Fig. 44; basitarsi of all legs and halteres pale, yellowish; male genitalia as in Figs. 41–43.

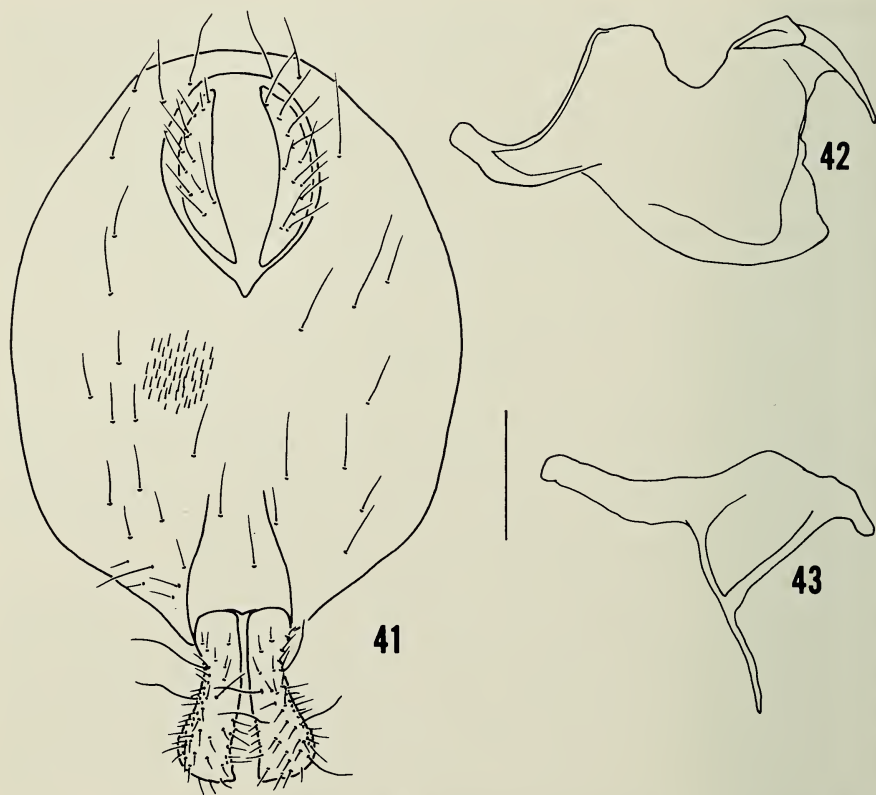
Description.—Small shore flies, length 1.61 mm (holotype).

Head: Head width-to-height ratio 1:0.70. Frons generally brown; parafrons darker in color than mesofrons; parafrons slightly cinereous to brown tinged with grayish green. Face slightly arched; interfoveal carina evident but weakly developed; antennal fovea distinct but shallowly impressed; facial color grayish brown ventrally, becoming more cinereous dorsally, particularly in antennal foveal depressions and laterad. Eye height-to-width ratio 1:0.84; eye-to-cheek ratio 1:0.14.

Thorax: Basitarsi and usually second and third tarsomeres pale, unicolorous, yellowish, contrasting distinctly with black tibiae of each leg. Wing maculation pattern (Fig. 44) as follows: cell R_1 with 4 white spots, spots at ends tending to be weaker; cell R_3 with 4 white spots; cell R_5 with 4 white spots, 2 darker brown spots aside from darker spot over anterior crossvein, each closely appressed to vein R_{4+5} ; discal cell with 2–3 white spots; cell M_2 with 2 spots, basal one constricted medially; cell M_4 with 2 white spots. Wing length-to-width ratio 1:0.50; costal vein index 1:0.29; M_{1+2} vein index 1:0.66. Halter brownish yellow.

Abdomen: Male genitalia (Figs. 41–43) as follows: epandrium (Fig. 41) in caudal view generally oval, rounded dorsally and ventrally, longer than wide; surstyli small, slender, becoming slightly wider apically, close together, densely setulose; aedeagus longer than wide in profile (Fig. 42) with anteroventral projection, dorsum with V-shaped notch; aedeagal apodeme as a slender process attached to posterior portion of aedeagus.

Type-material.—Holotype male, labelled: "Knowlton Ldg. QUE 18. VII. 68 J. R. Vockeroth." The holotype is in the Canadian National Collection,



Figs. 41-43. *Limnellia sticta*: 41. Epandrium and surstyli, caudal view; 42. Aedeagus, lateral view; 43. Gonite, lateral view.

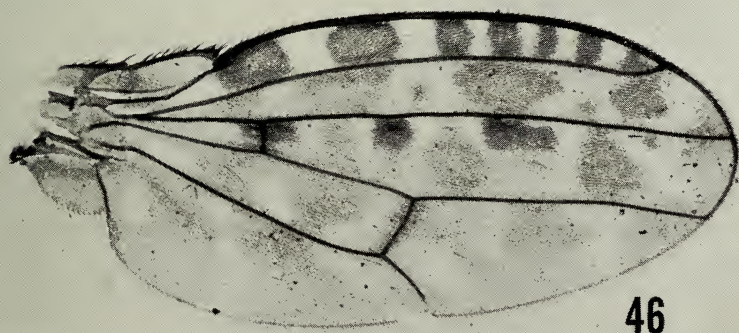
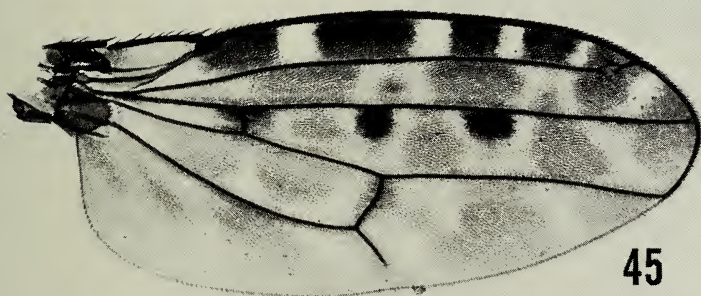
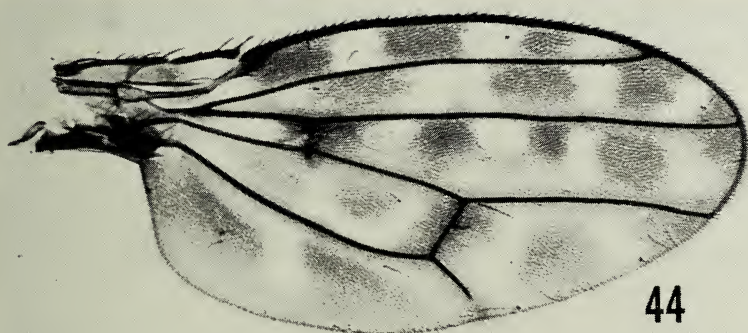
Ottawa, type number 15435. The right wing of the holotype has been removed and slide mounted; the postabdomen has been removed, dissected, and placed in an attached microvial.

Geographic distribution.—This species is known only from the type-locality.

Relationship.—I have placed this species near *L. lactea* and *L. stenhammari* as their sister-group based on similarities of the epandrium and surstyli of males of these species. Specimens of *L. sticta* differ from either congener by the paler halteres.

Etymology.—*Sticta* is derived from the Greek verbal adjective *stiktos*, meaning "spotted," in allusion to the spotted wings of specimens of this species.

Remarks.—*Limnellia sticta* is known only from the holotype specimen, and for this reason I was hesitant to describe it. But the excellent



Figs. 44-46. Wings. 44. *Limnellia sticta*; 45. *L. turneri* (Mt. Rainier—Berkeley Park, Washington); 46. *L. turneri* (Pullman, Washington).

condition of the specimen, its sex (male), the obvious differences in the shapes of the male genitalic structures, and the revisionary nature of this study justifies its description.

Limmellia turneri, new species

Figs. 45-50

Limmellia quadrata of authors, not Fallén. Osten Sacken, 1878:204 (catalogue).—Aldrich, 1905:630 (catalogue, as species of *Scatella*).—Sturtevant and Wheeler, 1954:177 (review, as species of *Scatella*).—Wirth and Stone, 1956:474 (key).—Wirth, 1965:758 (catalogue).

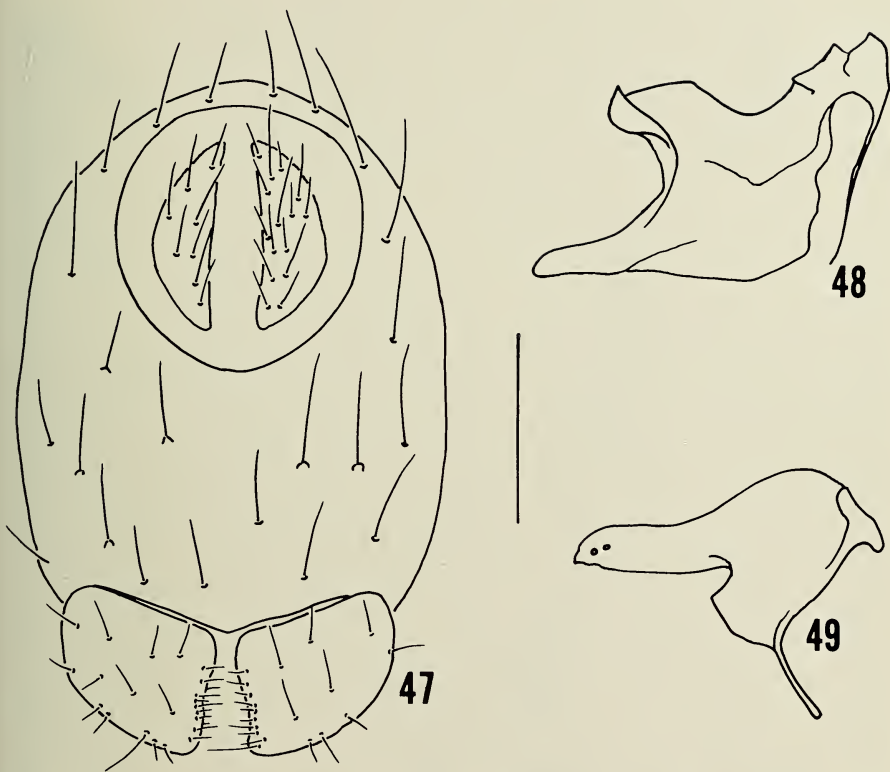
Diagnosis.—Specimens of *L. turneri* are distinguished from those of congeners by the following characters: setulose portion of face mostly unicolorous, grayish brown; antennal fovea distinctly impressed; wing maculation pattern as in Figs. 45-46; basitarsi of all legs mostly pale, yellowish to brownish yellow; halter brownish yellow to brown; male genitalia as in Figs. 47-49.

Description.—Small to moderately-small shore flies, length 1.31-2.47 mm.

Head: Head width-to-height ratio averaging 1:0.66. Frons generally brown, fronto-orbital plated darker than mesofrons; parafrons with anterior margin and linear area near vertex grayish green to cinereous; mesofrons with lighter brown, guttate areas laterad of ocellar triangle. Face generally brown; ventral margin frequently with some cinereous color, face above facial setae becoming more cinereous, cinereous color particularly evident in antennal fovea and laterad; face slightly arched transversely; interfoveal carina weakly developed but evident; antennal fovea distinct but weakly impressed. Eye height-to-width ratio averaging 1:0.87; eye-to-cheek ratio 1:0.16.

Thorax: Basitarsi of each leg generally paler, yellowish; frequently second and third tarsomeres concolorous with basitarsus, distinctly contrasting color of tibiae. Wing maculation pattern (Figs. 45-46) as follows: cell R_1 with 5-7 white spots, each more or less clearly defined; cell R_3 with 3-4 white spots, basal one weakly developed frequently, usually with 1 brown spot completely surrounded with white in line with posterior crossvein; cell R_5 with 4 white spots, usually with 2 darker brown spots, each closely appressed against vein R_{4+5} ; discal cell with 2-3 white areas along posterior margin, some extending slightly anteriorly; cell M_2 with 2-3 weakly developed white areas, basal one linear or subdivided; cell M_4 with 2-3 weakly developed white spots. Wing length-to-width ratio averaging 1:0.46; costal vein index averaging 1:0.19; M_{1+2} vein index averaging 1:0.54. Halter brownish yellow to brown.

Abdomen: Male genitalia (Figs. 47-49) as follows: epandrium (Fig. 47) in caudal view longer than wide, rounded dorsally, subtruncate ventrally, larger setae very long; surstyli wider than long, not fused indis-



Figs. 47–49. *Limnellia turneri*: 47. Epandrium and surstyli, caudal view; 48. Aedeagus, lateral view; 49. Gonite, lateral view.

tinguishably with ventral margin of epandrium, median angles slightly angulate, otherwise rounded, setulose; aedeagus nearly as high as long in profile (Fig. 48); aedeagal apodeme as a slender process attached to posterodorsal portion of aedeagus.

Type-material.—Holotype male, labelled: “MtRainier WN Berkeley Park 23 Aug. 1934 A. L. Melander/ ALMelander Collection 1961.” Allotype female and 28 paratypes (17♂♂, 11♀♀, USNM): with same label data as holotype. The holotype, allotype, and paratypes are in the National Museum of Natural History, Smithsonian Institution, type number 75475.

Other specimens examined.—237 specimens (89♂♂, 148♀♀). CANADA: Alberta: Laggan (1♀, USNM). British Columbia: Cultus Lake (1♂, 2♀♀, CNC); Point Grey—Vancouver (1♀, CNC); Robson (1♀, CNC); Terrace (1♂, USNM); Terrace—23 mi N (1♀, CNC); Victoria (1♂, CNC). UNITED STATES: Alaska: Anchorage (1♀, USNM). Douglas (2♀♀, ANSP, USNM). Matanuska—rotary trap (3♂♂, 2♀♀, USNM). Arizona: Coconino Co., Bill Williams (1♀, USNM). California: Los Angeles Co., Altadena (1♀,

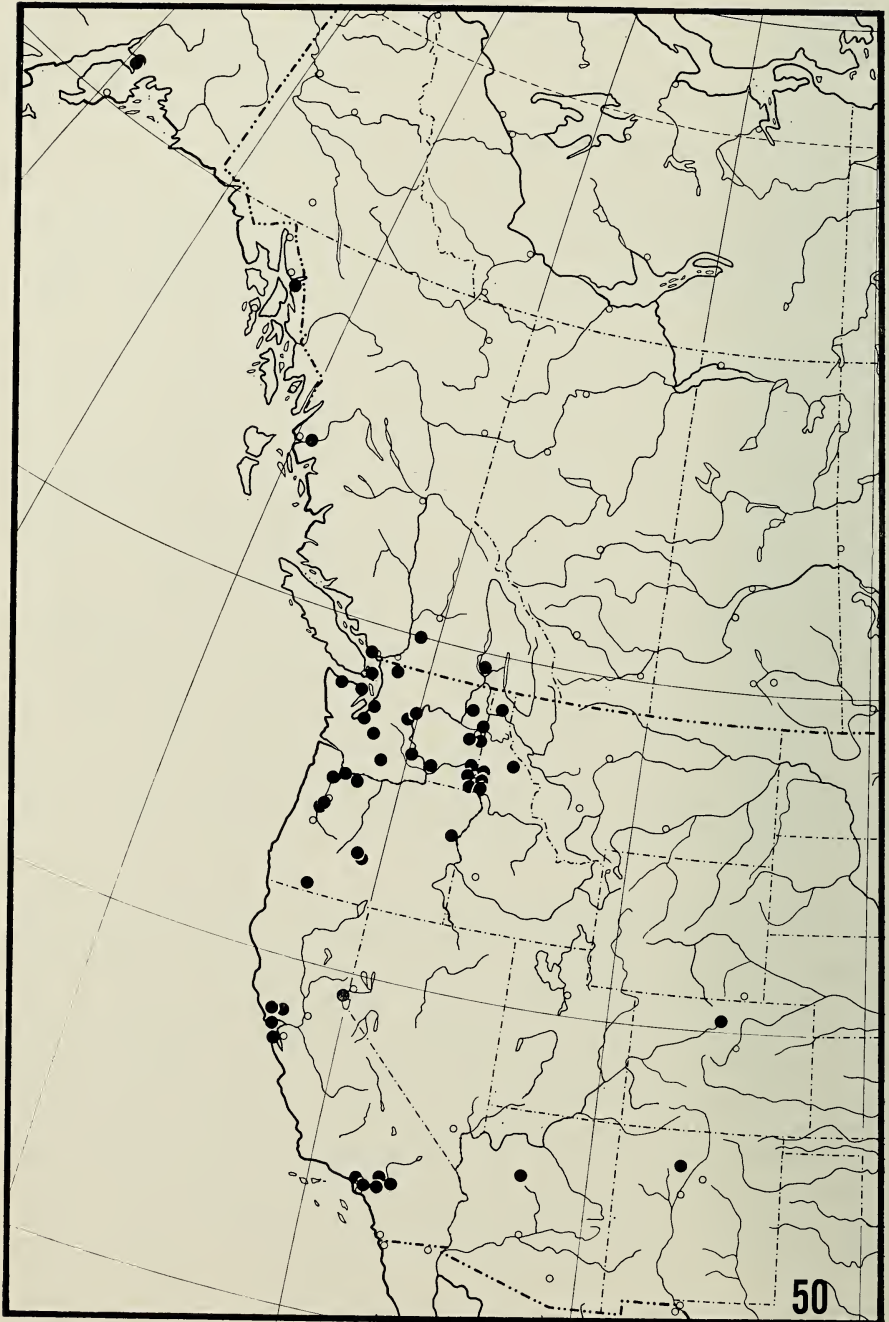


Fig. 50. Distribution map. *Limmellia turneri*.

USNM); Arcadia (1♀, USNM); Pasadena (3♂♂, USNM); Upper Santa Ana River (1♀, USNM); Whittier (1♀, USNM). Marin Co., Black Point (1♀, USNM). Mono Co., Mammoth Lakes (1♀, KU). Nevada Co., Sagehen Creek near Hobart Mills (1♀, WNM). Riverside Co., Riverside (2♀♀, USNM). San Bernardino Co., Barton Flat (2♀♀, USNM); Big Pines (4♂♂, 2♀♀, USNM); Crestline (1♀, USNM); Jenks Lake (1♂, 1♀, USNM); One-thousand Springs (1♂, USNM). San Francisco Co., San Francisco (1♂, 1♀, CAS, USNM). Sonoma Co., Santa Rosa (1♂, CAS). Yolo Co., Winters (1♀, USNM). Oak Glen (1♀, USNM). Colorado: Larimer Co., Estes Park (1♀, USNM). Idaho: Bonner Co., Priest Lake-Lookout Mountain (1♂, 8♀♀, USNM). Idaho Co., Craig Mountains (1♀, USNM). Latah Co., Moscow Mountain (11♂♂, 26♀♀, ANSP, USNM). Nez Perce Co., Lake Waha (1♂, 1♀, ANSP, USNM); Lewiston Grade (1♀, USNM); Lewiston Hill (3♀♀, USNM). Newman Lake (2♀♀, USNM). Snake River—Divide Creek (2♂♂, 1♀, USNM). New Mexico: Sandoval Co., pond 15 mi NW La Cueva-Hwy. 126, 8,500' (1♀, CAS). Oregon: Baker Co., Anthony Lake (1♂, WNM). Benton Co., Corvallis—on mustard bloom (5♂♂, 2♀♀, USNM); Marys Peak (1♂, WNM); Sulfur Springs (2♀♀, WNM). Dechutes Co., Paulina Lake (1♀, USNM); Sisters—15 mi S (1♀, WNM). Jackson Co., Ashland (1♀, USNM). Marion Co., Breitenbush—*Ceanothus* bloom (1♀, WNM); Woodburn (5♂♂, 1♀, USNM, WNM). Multnomah Co., Portland (1♀, USNM). Mt. Hood—6,000' (1♂, USNM). Utah: Utah Co., Aspen Grove—Mt. Timpanogos, 6,800' (1♂, ANSP). Washington: Asotin Co., Asotin—2 mi S (1♂, WSU); Fields' Spring State Park—4 mi S Anatone—3,500–4,000', dry ice malaise trap (5♂♂, 13♀♀, USNM, WNM, WSU). Chelan Co., Chelan (1♂, USNM); Cashmere (1♂, 1♀, USNM). Clallam Co., Fairholm—Lake Crescent (2♂♂, 2♀♀, USNM). Franklin Co., Eltopia—7 mi WSW (1♀, WNM). Garfield Co., Blue Mountains—Rose Spring (2♂♂, 1♀, USNM); Wawawai (2♀♀, USNM, WSU). Jefferson Co., Port Townsend (1♀, ANSP). King Co., Seattle (1♂, WNM). Pierce Co., Mt. Rainier National Park (1♂, WNM); Mt. Rainier—Burroughs Mt. (2♂♂, 1♀, USNM); Mt. Rainier—Fryingpan Trail (1♂, USNM); Mt. Rainier—Hansen Camp (1♂, USNM); Mt. Rainier—Narada Falls (1♂, USNM); Mt. Rainier—Paradise Park (1♂, USNM); Mt. Rainier—Van Trump Creek (1♂, ANSP); Mt. Rainier—Yakima Park (1♂, 2♀♀, USNM); Tacoma (1♂, USNM). San Juan Co., Orcas Island—Moran State Park, Lilly Pad Lake (1♂, 1♀, CAS); above Mt. Lake (5♂♂, 2♀♀, USNM). Spokane Co., Cheney (1♂, 1♀, UMI); Mica (1♂, USNM); Mt. Spokane (1♂, 2♀♀, USNM); Valley Ford (2♀♀, USNM). Steven Co., Deer Lake—3 mi NE (1♂, WSU). Whatcom Co., Mt. Baker—Skyline Trail (1♀, USNM). Whitman Co., Almota (5♀♀, WNM, WSU); Colton (3♂♂, 1♀, WSU); Union Flat (5♀♀, ANSP, USNM). Yakima Co., ANSP, USNM, WNM); Lyle Grove near Pullman (1♂, WSU); Pullman (4♂♂, 9♀♀, ANSP, USNM, WNM, WSU); Steptoe Canyon—5 mi W

Colton (3♂♂, 1♀, WSU); Union Flat (5♀♀, ANSP, USNM). Yakima Co., Mt. Adams (1♂, 1♀, USNM); Union Gap (1♀, WSU). Wyoming: Yellowstone National Park—Lewis Lake (1♀, USNM).

Geographic distribution (Fig. 50).—*Limnellia turneri* is a western North American species, ranging from Alaska (Matanuska) southward along the Pacific Coast in the west and the Rocky Mountains in the east to southern California (Los Angeles Co.), Arizona (Coconino Co.), and New Mexico (Sandoval Co.).

Natural history.—Several specimens were collected from the blossoms of mustard and of *Ceanothus*. In southeastern Washington, Dr. William J. Turner collected a large series from malaise traps baited with dry ice.

Relationship.—See my comments under *L. huachuca*.

Etymology.—The genitive patronym *turneri* honors my good friend and dipterist, Dr. William J. Turner, Washington State University.

Remarks.—In addition to the specimens listed above, I have examined five female specimens from the Great Smoky Mountains of North Carolina. These specimens represent either the present species or are a new, closely-related one. The wing maculation pattern of these specimens is very similar to wings of *L. turneri*, and I have deferred describing them as a new species because of the close resemblance. The Great Smoky Mountains, however, are far removed from the distribution outlined above, and these five specimens may well represent another species.

Acknowledgments

All curators and their respective institutions cited above are gratefully acknowledged for permitting me to study collections in their care. I am also thankful to Drs. Wayne E. Clark, Willis W. Wirth, and Oliver S. Flint, Jr. for critical review and suggestions of an earlier draft of this paper. Thanks are also due Miss Hollis B. Williams, who prepared all distribution maps; Miss Anne Halpern, who typed the final draft; Mr. Victor E. Krantz, who made the wing photographs; and Mr. George C. Steyskal, who assisted with the etymology sections.

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